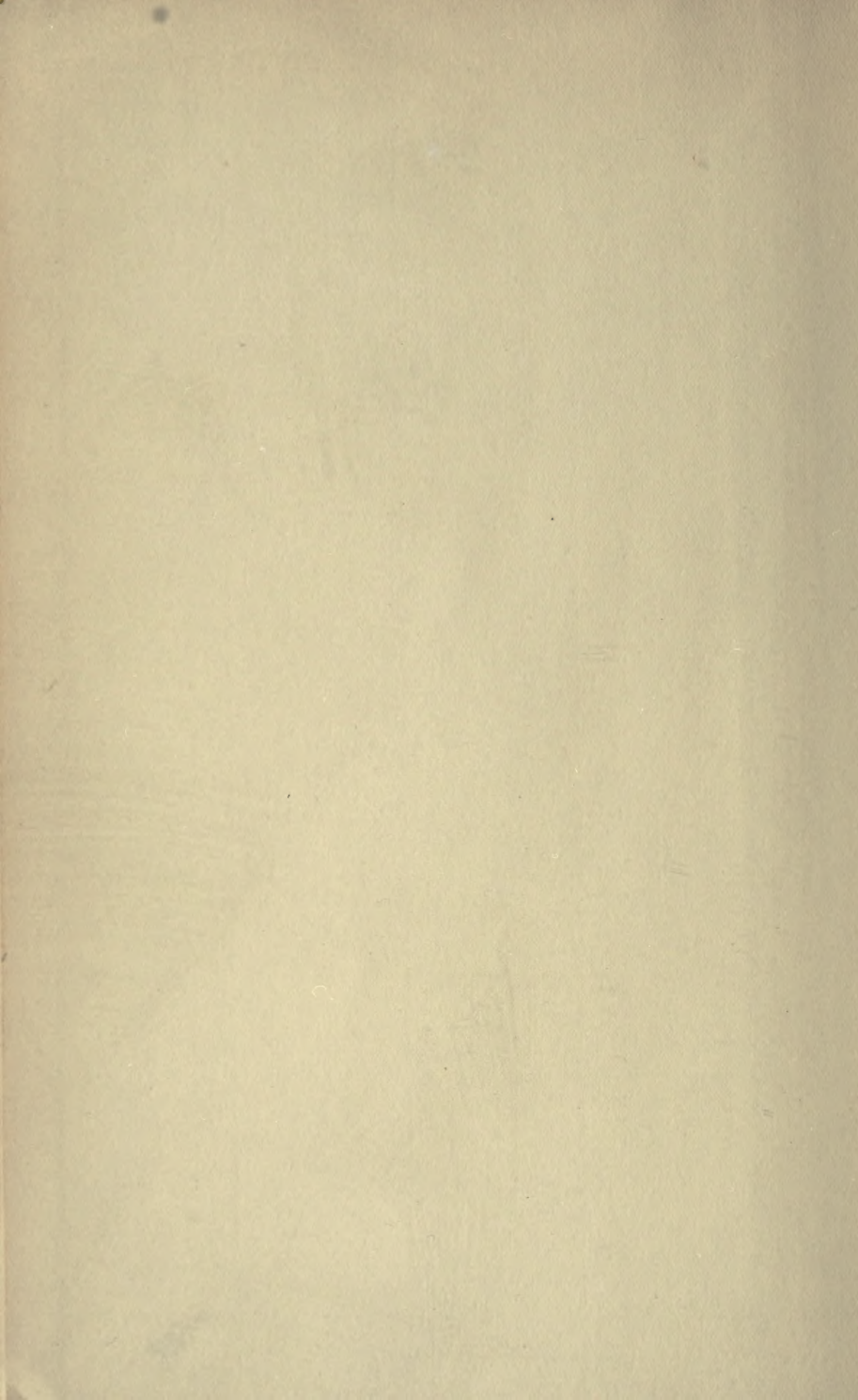


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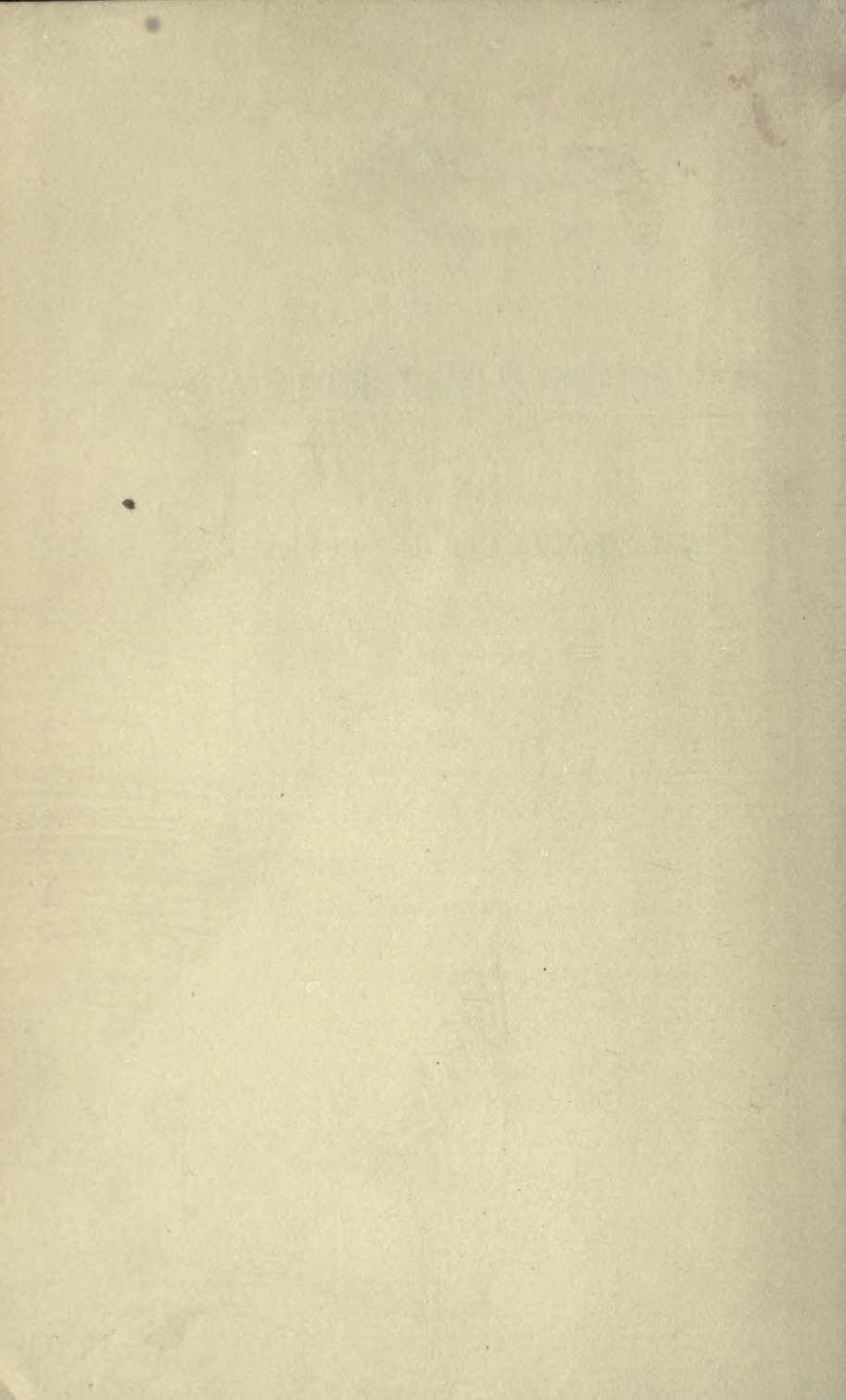
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XX

THE TIN-PLATE INDUSTRY



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THE TIN-PLATE INDUSTRY

A COMPARATIVE STUDY OF
ITS GROWTH IN THE
UNITED STATES
AND IN WALES

By D. E. DUNBAR



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BOSTON AND NEW YORK
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TO
PROFESSOR FRANK WILLIAM TAUSSIG
FRIEND AND TEACHER



PREFACE

THIS series of books owes its existence to the generosity of Messrs. Hart, Schaffner & Marx, of Chicago, who have shown a special interest in trying to draw the attention of American youth to the study of economic and commercial subjects. For this purpose they have delegated to the undersigned committee the task of selecting or approving of topics, making announcements, and awarding prizes annually for those who wish to compete.

For the year ending June 1, 1914, there were offered:—

In Class A, which included any American without restriction, a first prize of \$1000, and a second prize of \$500.

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The present volume, submitted in Class A, was awarded the first prize in that class.

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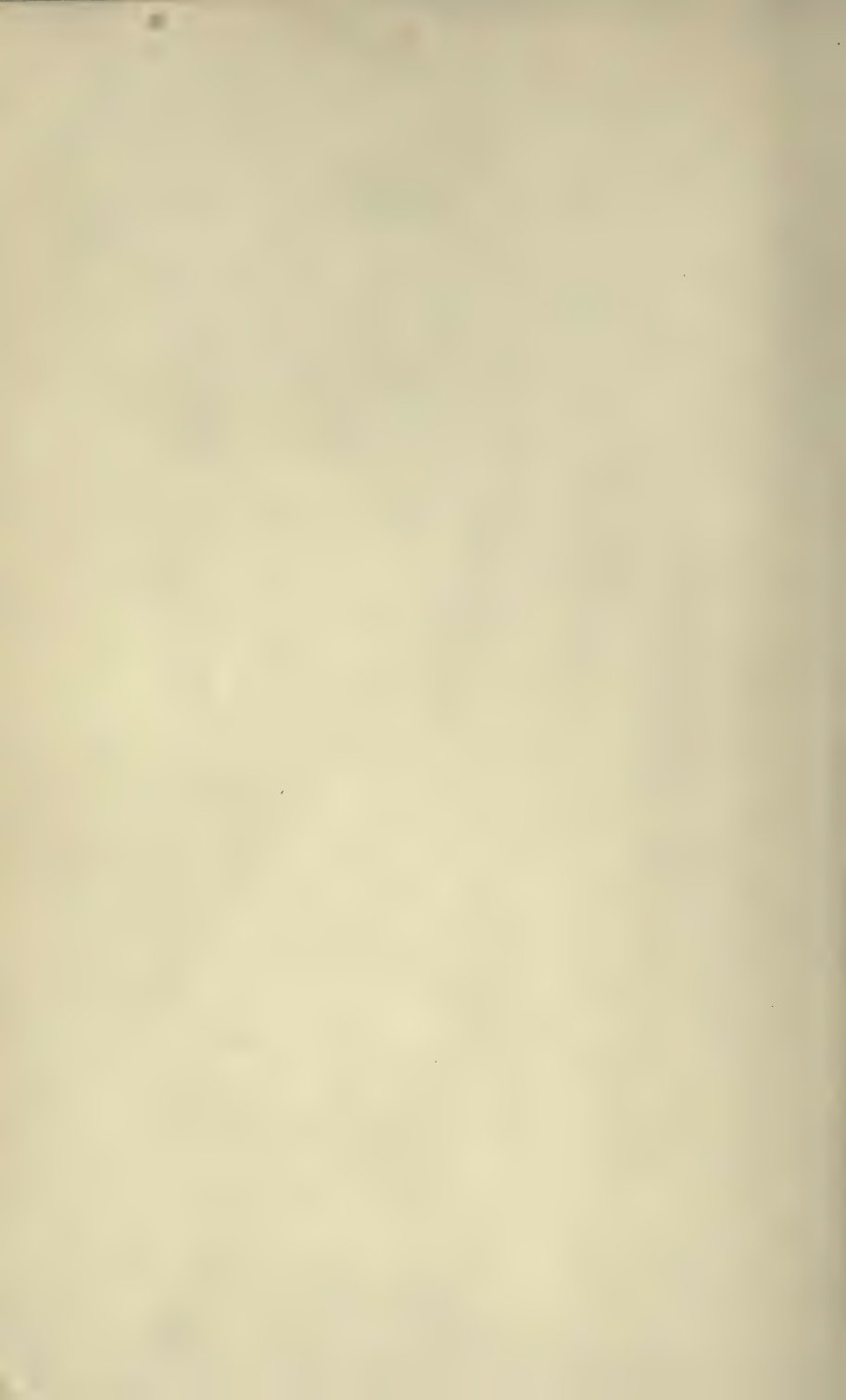
AUTHOR'S PREFACE

FOR twenty-five years a fierce controversy has raged over the subject of tin-plate making, both in Wales and the United States. Few industrial changes of the last quarter of a century have roused so much contention and debate as the growth of the tin-plate industry in America and its vicissitudes in Wales. To-day this chapter of industrial history is past and closed, and the time is most opportune for a complete presentation of the case.

In addition to its timeliness this study deals with the economic problems that are so prominently before the American Republic at the present moment. Questions of tariff policy, the trust enigma, and problems of labor are encountered in this investigation, and their detailed examination throws light on some of the great difficulties that beset the American people. Moreover, study of Welsh conditions helps us to understand many of the economic developments now taking place in England.

Throughout this study the aim has been to present as succinct an account as possible; to concentrate details, and to expel all extraneous matter. For example, nothing is said concerning tin, because it is a world product, and all manufacturers, whether American or Welsh, procure it on equal terms. Recourse has been made to varied sources to secure the materials of the work. The author has done field work in this country and in Wales, and has corresponded with manufacturers and trade editors. Other principal sources of information are trade journals, technical journals, and official investigations embodied in tariff hearings and reports. In order to secure accuracy the attempt has been made throughout to verify all statements of fact through several sources.

DONALD EARL DUNBAR.



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THE TIN-PLATE INDUSTRY

CHAPTER I

ORIGIN AND GROWTH OF TIN-PLATE MAKING

A TIN PLATE is a thin sheet of iron or steel coated with tin and possesses the strength of iron or steel without the liability to rust. The tinning of iron plates is said to have originated in Bohemia, where the processes of manufacture were very crude and carefully guarded by their possessors.¹

In 1620 an ambitious Duke of Saxony obtained the secrets of the Bohemian trade through the medium of a false priest and introduced the industry into Saxony. It was from this country that England learned the process, for in 1665 one Andrew Yarranton visited Saxony and learned the method of manufacture. He strove to establish the industry in his own country, but was frustrated, when, in 1691, an exclusive monopoly for plating and tinning iron, copper, and other metals was granted by the Crown to one William Chamberlain. The latter, however, was unable to create a successful concern, and interest in the production of tin plate seems to have lapsed until 1720, when the manufacture began its career in Wales.²

Previous to this date the industry took root in Alsace

¹ Parliamentary Documents. *Report on the Conditions of Employment in the Manufacture of Tin Plates*. By E. L. Collins, Her Majesty's Medical Inspector of Factories, and J. Hilditch, Her Majesty's Inspector of Factories, 1912, Cd. 6394, pp. 3-4.

W. P. Flower, *History of the Trade in Tin and Tin Plates*. London, 1875.

R. B. Thomas, "Manufacture of Tin Plates." *Proceedings of the Institution of Mechanical Engineers*, 1906, p. 498.

² E. Trubshaw, "Tin Plate Manufacture." *Proceedings of the Iron and Steel Institute*, 1883, vol. 4, p. 252.

and Germany.¹ The French scientist Réaumur, writing in 1725, described the manufacture as carried on in Germany.² The sheets were made from iron bars, about one and one sixteenth inches square. These were slightly flattened by hammering and then cut into pieces, called "soles." In order to reduce them to smaller gauge the soles were doubled and hammered into thin sheets. Then the doubled soles were hammered in bundles of forty to the required thickness. Workmen next cut the sheets to size with hand shears, scrubbed them with sandstone, and pickled them in water acidulated by the action of fermenting cereals. The pickling process was carried on in vats placed in enclosed arched vaults, in which large fires were burning. The picklers had to enter these vaults occasionally to turn the sheets in the pickling bath and because of the intense heat wore no clothing. After the pickling, the sheets were cleaned with sand and then placed in water ready for tinning. Réaumur's description of tinning is as follows:—

"The tin is melted in a large iron pot, heated from below, and the sheets are placed in edgewise, so that the tin covers them. The tin must have a certain degree of heat; if too hot it does not stick to the iron, or sticks in large drops, or the sheets are not white, but have red patches mixed with yellow and blue. Some sheets receive a single coating, others receive two; for these, the first bath must be hotter than the one which follows or the second coating will roll off. This precaution is important. The second pot in which the sheets are dipped must be covered with white grease, not black. . . . Sal ammoniac dissolved in water has been tried as a coating preparatory to tinning, but not with much success. The method employed in Germany, and in French works, is to have a coating of grease on the surface

¹ Parliamentary Documents. *Report on the Conditions of Employment in the Manufacture of Tin Plates*, 1912, Cd. 6394, p. 3.

² M. de Réaumur. *Dissertation on the Elements of the Art of Making Tin Plates*. Translated from the *History of the Academy of Science*, Paris, 1725.

of the melted tin in the first pot. A special kind of grease must be used, common grease is not suitable."

Another account ¹ of the manual process of tinning as carried on at Mansvaux, Alsace, where the trade was introduced in 1714, tells of a secret ingredient of the tinning metal, supposed to be copper, and describes the cleaning and polishing of the plates with moss and sawdust.

Wales was endowed by nature for the production of tin plate. It was rich in coal and iron, was near the tin mines of Cornwall, possessed much water power, and an industrious population. The early *entrepreneur* was Major John Hanbury, who established a small plant at Pontypool. Under Hanbury came, in 1728, the first great improvement in the industry, the introduction of the "art of expanding iron bars by compressing cylinders." ² The process of rolling iron between two heavy, revolving cylinders revolutionized the trade. This advance was followed by several important innovations during the course of the next one hundred and fifty years.

In 1745 the grease pot was introduced for warming and preparing the surface of the iron sheets to receive the coating of tin. Pit coal began to be utilized in 1770 as a substitute for charcoal in the manufacture of iron. The crude method of pickling the iron sheets in barley water gave way to the use of vitriol in 1806, and in 1874 Grey introduced the pickling machine to do away with hand labor. The annealing pot was devised in 1829 by Mr. Thomas Morgan. In 1866 a very important innovation was made by Mr. Edmund Morewood and Mr. John Saunders, who invented

¹ *Encyclopédie ou Dictionnaire Raisonné des Sciences, des Arts et des Métiers*, par une Société de Gens de Lettres. Publié par M. Diderot, Paris, 1756.

² Parliamentary Documents. *Report on the Conditions of Employment in the Manufacture of Tin Plates*, 1912, Cd. 6394, p. 4.

E. Trubshaw, *Proceedings of the Iron and Steel Institute*, 1883, vol. 4, p. 252.

R. B. Thomas, *Proceedings of the Institution of Mechanical Engineers*, 1906, p. 499.

the so-called patent rolling of tin plates as they left the tinning pot. The principle was simple; it consisted of submerging a pair of revolving rollers in a pot of hot grease and in passing the plates between them to regulate the coating of tin. Not only did this invention effect a saving of tin, but it also prepared the way for future improvements in the tinning of plates.

The greatest advance of the nineteenth century, comparable, indeed, to the introduction of the rolling mill, was the substitution of Siemens's soft steel for charcoal iron in 1875, and that of Bessemer steel for puddled bar iron in 1880. During the following decade steel supplanted iron as the basic material for tin plate. The advantages of steel over iron are its greater ductility, superior tensile strength, and smoother surface, which is better suited for tinning. This account of technical progress brings us down to about the year 1890, which marked the end of a period of rapid growth in the Welsh industry.

The table below depicts the progress of the industry.¹

Year	Works (P. W. Flower)	No. of mills	No. of persons
1750	4		
1800	6		
1825	16	(R. B. Thomas E. Trubshaw)	(R. B. Thomas estimates) 5,200
1850	34		
1858		109	
1860	40		5,700
1865	47		
1868		171	
1870	50		9,200
1875	75		
1878		218	
1881	Inspector of factories	389	(Mr. Whymper 29,000)
1891	80	525	25,000

¹ R. B. Thomas, *Proceedings of the Institution of Mechanical Engineers*, 1906, p. 498.

E. Trubshaw, *Proceedings of the Iron and Steel Institute*, 1884, vol. 4, p. 252.

Parliamentary Documents. *Report on the Manufacture of Tin Plates*, 1912, Cd. 6394, p. 4.

After the introduction of steel the growth of the industry was very rapid. In the two decades before 1890 the number of hot mills more than doubled, and the output increased threefold. Flower estimated in 1875 that the annual production was 3,000,000 boxes; in 1887 Her Majesty's Inspector of Factories for Wales placed the annual output at 11,000,000 boxes, and in 1891 Mr. R. B. Thomas states that the industry made over 13,000,000 hundredweight.¹ The demand for tin plate was augmenting rapidly, for the use of steel as the basic material brought great technical progress in tin can and utensils manufacturing. Automatic machinery that stamped cans and utensils out of single pieces of tin plate resulted from the use of steel, and was in turn to be a constructive factor in the history of the tin-plate industry.

An interesting account exists of the process of tin-plate making at this period, when Wales was the sole producer and enjoyed practically a monopoly of the world's markets.² This description was written by Her Majesty's Inspector of Factories for Wales in 1888. It is especially important for this study, as it describes the Welsh industry at the height of its prosperity, before the growth of a rival in America. It is a descriptive index from which we measure the progress that has since ensued in Wales, and in the United States.

The inspector's general impression of the works in Wales was not very favorable, for he asserts that the buildings were old and dilapidated and very irregular because of haphazard additions. He writes:—

"Rubbish of old iron, disused machinery of all sorts and shapes, rubbish of wood, of bricks, of coal, of shearings are everywhere. You lift your eyes and you find the field of sight intersected perpendicularly, horizontally, diagonally,

¹ Parliamentary Documents, *Report of Her Majesty's Chief Inspector of Factories*, 1888, pp. 45 - 59.

² *Ibid.*

in every sort of direction, by uprights supporting the roof, by steam pipes reaching from wall to wall, now high up, now very little above your head, by oscillating beams, by flues of furnaces, by elevation of all sorts of shapes, but all black. . . . Whether a tin-plate works be old or new, neither is the immediate neighborhood or the inside a place to linger in. . . .”

Then he proceeds to explain carefully the method of making tin plate.

The process of manufacture begins with the cutting of the sheet bar of mild steel, which is six to ten inches wide and three eighths to seven eighths inch thick. This is cut into slabs twenty inches long and then carried on trucks to the hot mills. A mill consists of two stands of rolls that are twenty-six inches long and nineteen inches in diameter and chilled to a depth of about three fourths inch. One pair of rolls is called the roughing stand, the other the finishing. Opposite the rolls, and about twelve feet away, are two furnaces, the roughing for the roughing rolls, and the finishing for the finishing rolls. The mill crew comprises four workers, the rollerman, the furnaceman or heater, the doubler, and the behinder or catcher, a youth. The slabs are heated five times and rolled in five stages.

(1) The slabs are piled in the roughing furnace, and when red-hot are withdrawn in pairs and passed through the roughing rolls. The long edge of each piece is presented in turn to the nip of the rolls, so that the stretch is in the direction of the width. The two pieces are passed alternately, one being returned over the rollers by the catcher as the other goes through, until they have had four or five passes and are rolled out into thin sheets of 8 B.G.¹ (0.1520 inch). After this “roughing” or breaking down of the slabs, they are returned to the furnace, from which they were taken, for reheating.

¹ Birmingham Gauge.

(2) In the second operation each slab is withdrawn from the furnace singly and passed twice through the roughing rolls, which reduce it to 14 B.G. (0.0785 inch). Then the doubler takes the sheet and doubles it over on itself, and flattens the doubled edge by placing it under the "crocodile" squeezer operating at one side of the mill. The squeezer and shears for cutting the doubled edges are attached to the main shaft so that they are in continual operation with the rolls. The doubled piece is now returned to the finishing furnace for reheating.

(3) In the next stage the once-doubled pieces are withdrawn singly from the finishing furnace and passed through the finishing rolls, then doubled over on themselves and flattened under the squeezer. The slab has now been doubled twice and consists of four sheets. The purpose of this constant doubling and redoubling is to reduce the separate sheets to a smaller and smaller gauge. The thickness of the pack of four sheets is now 14 B.G. (0.0785 inch).

(4) After reheating in the finishing furnace the same operation is repeated, and after the doubling, the pack consists of eight sheets ("eights"). It is now returned to the finishing furnace for the final heating.

(5) The last stage in the rolling process is to pass the "eights" through the finishing stand until they have the required length. In the rolling of the standard 14×20 sheets, the pack becomes 20×42 inches and cuts into twenty-four sheets.

The rolling of the sheet bar into a pack of thin sheets is a laborious task that must be done by skilled workmen. The temperature in the mill is very high, and the men wear little clothing at their work. The hot mills run continuously, and are worked by three shifts of eight hours each. The skilled workmen are organized in strong unions that impose a strict limit of thirty-six boxes per shift and in some works thirty-two boxes. Less than thirty boxes is probably the actual output per turn.

Shearing

When the rolled packs have cooled, they pass to the shearman to be cut to the desired size. The shears are of the "crocodile" type and are driven by gearing from the main shaft of the hot mills. Thus the shears are always in operation and uncontrolled by the shearman, who must be well trained to synchronize his movements with those of the machine. Besides the skilled workman there is a boy to bundle scrap.

Opening

In the process of rolling the doubled and redoubled sheets become slightly welded, and after they are sheared to size, they pass to the openers' bench. There women and girls take the laminated packs, and holding them in an upright position strike one corner against the bench so as to bend and separate the corners of the sheets. Then they tear the sheets apart by means of a piece of metal in the palm of the hand. Should the sheets stick, they cleave them apart with a heavy knife.

Pickling

After being separated the sheets pass to the pickling process to be cleared of oxide of iron, thin films of which have covered the surface of the sheets and caused the lamination. The black pickling bath consists of swilling in sulphuric acid, followed by immersion in water. Hand pickling has been eliminated by the Grey machine, which consists of an overhead trolley from which cradles are suspended over two vats, one for sulphuric acid and the other for water. By means of a lever arrangement the cradles may be lowered into the vats and then agitated up and down in order to clean the sheets thoroughly. Girls pack the sheets in the cradles and unpack them after they are washed. Each cradleful is first cleaned in the vitriol bath and then washed in water. The pickling department is

generally a dirty and unwholesome place. The workers are exposed to wet floors, acid fumes, and general humidity, due to vapors from the pickling vats.

Annealing

At this stage of manufacture the sheets are hard and brittle. In order to make them tough they are packed on stands and covered with cast-iron annealing pots. Seven or eight men then place the pots on the end of a forked carriage and push them into the annealing furnaces. The heat is so intense that these annealers have to be trained men to do the work and endure the high temperature. The plates remain in the annealing furnace from ten to twelve hours and are subjected to an intense heat. This annealing renders them tough.

Cold-rolling

The purpose of passing the sheets through the cold rolls is to give them a good surface. The rolls are similar to those of the hot mills, except that they are run at a much higher speed, and subject the plates to a very high pressure. The cold rolls are generally arranged in a line, often on the same shaft with the hot mills. Little boys and girls feed the sheets and carry them back and forth. Boys sit on benches before the stands and present the sheets one by one to the nip of the rolls. As the once-rolled sheets accumulate on the other side of the stand, little girls and boys gather them up and bring them back to the cold-roller's bench to be passed through again. Three passes constitute the cold-rolling process.

As the cold-rolling makes the sheets brittle again, they have to undergo another annealing of shorter duration, eight hours, and of less intense heat. This is called the "white annealing."

During the cold-rolling and second annealing films of oxide of iron form on the sheets and must be removed by

another pickling. In trade parlance this is the white pickling. The sulphuric acid is not so strong as in the black pickling process.

Tinning

The purpose of the processes described above is to prepare the black plate for tinning. The sheets are called black plate. After the second bath in sulphuric acid the sheets remain in water until ready for tinning, which is done by the "five-pot" process. The top of a long brick dresser contains five oblong troughs, heated by fires from below. Standing in front of the dresser are three men, known as the tinman, the washman, and the riser. They are flanked by several girls, called "branners" and "cleaners." Into the first pot containing boiling palm oil the tinman places the sheets one by one and leaves them immersed from one to five minutes in order to clean the surface of all impurities and make it absorbent. Next he transfers the sheets to the second pot which holds molten tin. They remain immersed from two to five minutes, and their surface forms an amalgam with the tin. In the third pot the tin is purer and hotter, and here the sheets receive a second coating. The washman removes the sheets from the third pot, and placing them on the hearth in the middle of the dresser brushes them with hemp to take off surplus tin. Then he dips them in the fourth pot which contains the purest tin. Finally, the riser immerses the sheets in the boiling grease of the fifth pot through a pair of revolving rolls. The pressure of the rolls regulates and makes uniform the coating of tin.¹

In the tin house the workmen engaged in coating the sheets are skilled. The immersion in the various pots must be done in a certain way, and the success of the operation depends on the training and skill of the dippers.

¹ *Iron Age*, January 28, 1892, p. 161. Description of manual tinning.

Cleaning and polishing

Girls take the tin plates as they emerge from the grease pot and pass them through an absorbent cleaning material ("pink meal," or "shudes" and "sharps") to remove the grease. While the tin plates are still hot, other girls polish them with sheepskin. Then the finished product is ready to be sorted and packed.

Such was the process of tin-plate manufacturing as it was practiced in Wales about 1890, after an evolution of nearly two centuries. There had been great changes in methods, such as hot rolling, machine pickling, annealing, and patent tinning, but the making of tin plates still depended upon the skill, developed and inherited through many years, of the inhabitants of Monmouthshire, Glamorgan, Carmarthen, and one or two other counties in Wales. Zealously did the Welsh oppose all changes that tended to upset the trade's organization. Whole families worked in the mills. Boys entered the trade when still young and grew up in it, while wives and sisters followed the work open to them. The industry had developed very little on the Continent, and Wales was the great producer for the world. The strength of the Welsh industry was due in great measure to the inherited skill of a tin-plate community, but, paradoxical though it may seem, this source of strength was also a cause of weakness. The work-people were clannish and ultra-conservative, and countenanced no innovations that disturbed the course of trade.

In spite of her position of monopoly and reliance on the technical skill of her people, Wales was in a perilous situation, for she sold seventy per cent of her total production of tin plate to the United States and exported some to scattered markets.¹ Any incident that closed the American market was sure to plunge the industry into a demoralizing depression and even to threaten it with ruin. Signs of the

¹ Parliamentary Documents, *Reports on Trade and Navigation*.

times pointed that way, for already in the new and intensely industrial United States the forces were at work that were to rob Wales of her one great market and to convert it into her strongest rival. Warnings were sounded in England and admonitions to seek other markets were given, but Wales continued to expand her output and to send more and more of it to the United States. In 1871 the imports into America were 82,969 tons; in 1890 they amounted to 329,000 tons.¹ In that year the Congress of the United States passed the McKinley Tariff Act that was to deal Wales a staggering blow.

¹ *Report of American Iron and Steel Institute, 1891, p. 25.*

CHAPTER II

GROWTH OF THE INDUSTRY SINCE 1890

SINCE the McKinley Act became law in 1890 the United States has become the greatest producer of tin plate in the world. In 1890 this country did not produce any tin plate at all; to-day it turns out about 1,000,000 tons per year. At that time America imported all she used; now all she uses she makes, and in addition exports increasing quantities to foreign markets. Truly this has been a spectacular industrial transition.

Previous to 1890 tin plate had never been subjected to duties comparable to those on other manufactures of iron and steel. By the Act of 1862, a duty of 0.5 cent per pound was imposed and retained until 1864, when it was increased to 2.5 cents per pound.¹ However, this duty never went into effect because of a misinterpretation of the act by the Secretary of the Treasury, who showed his total ignorance of the nature of tin plate by giving it an absurd classification and subjecting it to a tax of 15 per cent *ad valorem*. In 1875 the rate became 1.1 cents, equivalent to about 20 per cent, at the price then ruling. While this duty was in force three plants were organized, but they did not prove successful.² A decline in the price of tin plate proved their ruin. The next change in the tariff came in 1883, when a duty of one cent per pound went into effect. This was

¹ *Tariff Acts Passed by the Congress of the United States*. Compiled by R. G. Proctor. Washington, 1898, pp. 180-204.

F. W. Taussig, *Tariff History of the United States*, 6th ed. rev., p. 272.

² F. L. McVey, "The Tin-Plate Industry," in Ripley, *Trusts, Pools, and Corporations*, p. 296.

Report of the American Iron and Steel Institute, 1892, pp. 27-29.

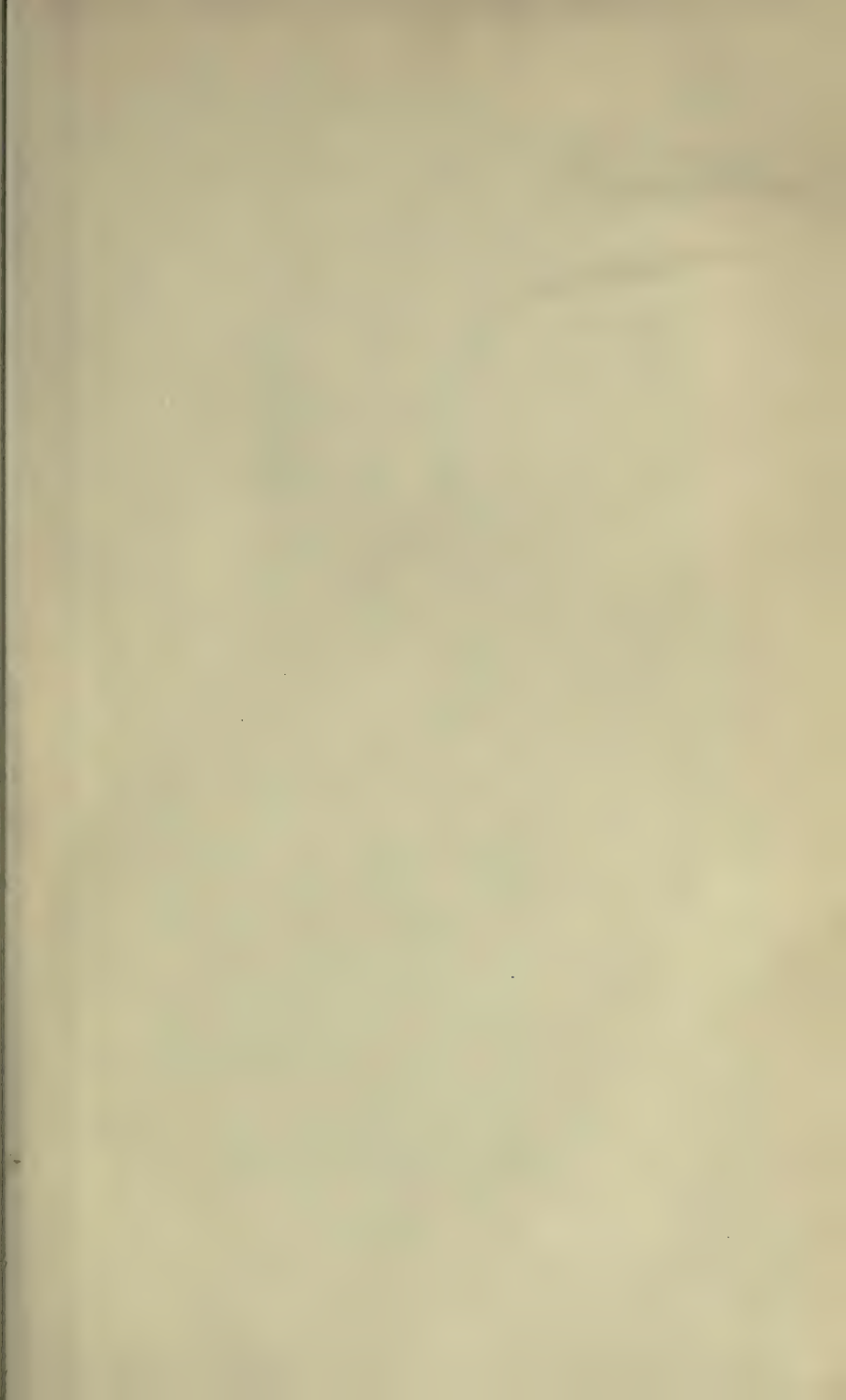
Tariff Acts of the United States, *op. cit.*, p. 265.

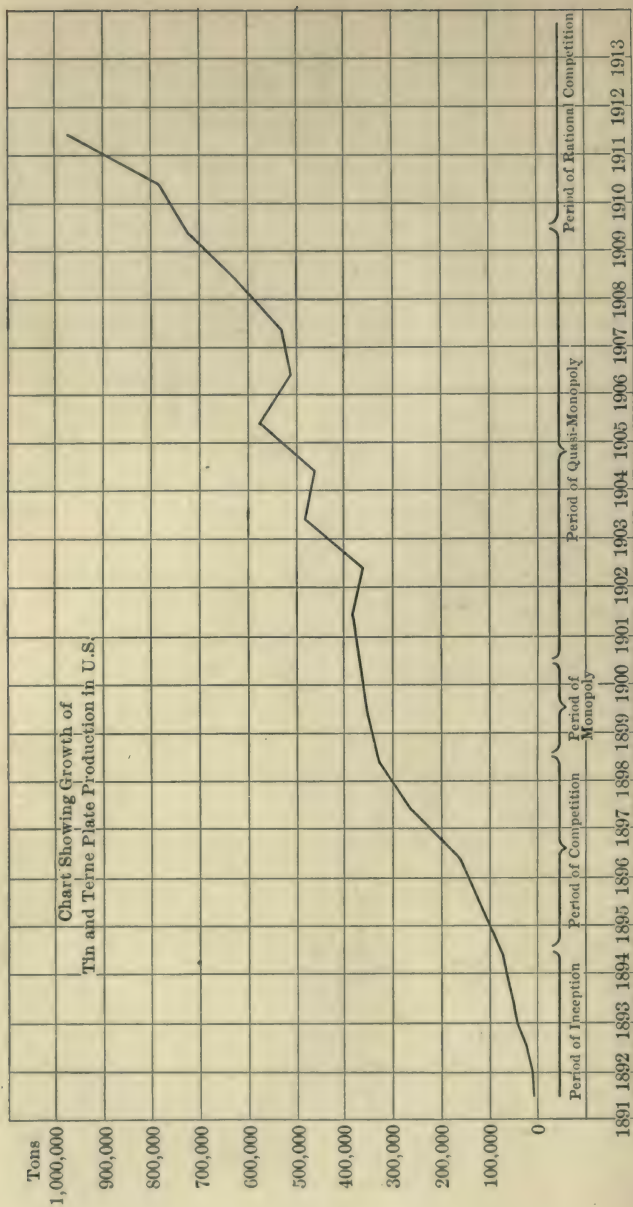
purely a revenue duty, for no domestic production was attempted under it, and the entire American consumption continued to be supplied from Wales. The obstacles to the growth of the industry in this country were the lack of technical information, the absence of skilled labor, and the high price of steel.

The McKinley Act, in so far as it concerns the tin-plate industry, is a supremely good example of timely legislation. Congress sanctioned the act October 1, 1890. The clause relating to tin plate went into effect July 1, 1891. It was declared that after that date tin plate should pay a duty of 2.2 cents per pound, but it also added that "after October 1, 1897, tin and terne plates lighter than 63 pounds per one hundred square feet should be admitted free of duty, unless it shall be made to appear to the satisfaction of the President that the aggregate quantity of such plates lighter than 63 pounds per one hundred square feet, produced in the United States during any of the six years next preceding June 30, 1897, has equaled one third the amount of such plates imported and entered for consumption during any fiscal year after the passage of this act and prior to October 1, 1897."¹ The purpose of the provision was to establish a period of probation for the prospective industry. If it did not attain a certain figure of production, protection was to cease. This provisory clause, however, was soon lost sight of, for the rapid growth of the industry exceeded the expectations of even its most sanguine supporters.

The table on page 15 shows the production of tin plate through the different periods of the industry's history.

¹ McKinley Act, October 1, 1890. *Tariff Acts of the United States, op. cit.*, p. 333. The Act also levied a duty of four cents per pound on pig tin, to take effect July 1, 1893, and to continue for two years. If at the end of this period the production reached 5000 tons, the duty was to continue. This duty on tin encountered a great deal of opposition and was repealed in 1894. It was evident that tin could not be produced commercially in this country. London is the world's market for tin, which comes from the Straits Settlements, Australia, Cornwall, China, Tasmania, Bolivia, etc.





*Production of tin and terne plate in the United States —
1891-1914*¹

<i>Duty</i>	<i>Year</i>	<i>Tons</i>	<i>Per cent of increase</i>
2.2¢ per lb.	1891	999	
	1892	18,003	2000
	1893	55,182	200
	1894	74,260	33
1.2¢ per lb.	1895	113,666	52
	1896	160,362	41
	1897	256,698	60
	1898	326,915	27
	1899	360,875	10
	1900	379,665	5
	1901	399,291	5
1.5¢ per lb.	1902	360,000	-10
	1903	480,000	33
	1904	458,000	-4
	1905	493,500	7
	1906	577,562	17
	1907	514,774	-10
	1908	537,-87	4
	1909	611,959	13
1.2¢ per lb.	1910	722,770	18
	1911	783,960	8
	1912	962,971	22
	1913	823,719	-15
15%	1914	900,000 (estimate)	

The history of the industry in this country may be divided into five periods. The first four years were a time of experiment and trial, and may be called the "period of inception."² The following four years saw the industry firmly established, for in 1895 the American manufacturers had captured the domestic market. During these years competition was increasing rapidly; in fact, this may be designated the "period of competition."³ In December, 1898, was formed the American Tin-Plate Company that possessed a complete monopoly of the field and dominated the industry until 1901. The appropriate title for this por-

¹ *Reports of the American Iron and Steel Institute, 1891-; Iron Age, 1891-.*

² *Iron Age, January 7, 1892, pp. 20-21.*

³ *Ibid., August 19, 1899, p. 15.*

tion of our story is the "period of monopoly." Although the power and relative strength of the American Tin Plate Company have declined since 1901, price agreements in the trade have been so efficacious that the years from 1901 to 1911 constitute a period of quasi-monopoly. From that time on the more appropriate term for the situation in the industry is the phrase, "rational competition."

A brief survey of this fascinating industrial history will serve to fix the characteristics of the different periods in our minds. We must remember that one fundamental cause of the phenomenal growth of the industry has been the huge and ever enlarging demand for tin plate for innumerable uses.¹ The canning industry has had a tremendous growth. Cooking-utensils; tin receptacles of all sorts for tobacco, cigarettes, and candy; toys; tin roofs; bottle tops; and a host of other uses absorb enormous quantities of tin plate. One of the essential principles underlying the McKinley Act was that domestic producers should satisfy this huge domestic demand. Another primary factor in the movement that led to the establishment of the industry in this country was the development of the steel industry that became so marked in the eighties. The important steps in this development were the bringing together of iron ore and fuel through the extension of transportation facilities, and the improvement of the Bessemer process for making steel. The price of steel fell rapidly and stimulated all branches of the industry.² The chief raw material of tin-plate mak-

¹ Parliamentary Documents. *Reports on Trade and Navigation.*

Iron Age, January 9, 1908, p. 43.

F. L. McVey, in Ripley, *op. cit.*, p. 292 ff.

Tariff Hearings, vol. 2. Committee on Ways and Means, 62d Congress, 3d Session, 1912-13, House Documents, vol. 128, p. 1132.

² F. L. McVey, in Ripley, *op. cit.*, p. 299.

A. Berglund, *The United States Steel Corporation*. New York, 1909, p. 46 ff.

Iron Age, August 19, 1897, p. 15; *ibid.*, December 29, 1892.

F. W. Taussig, "The Iron Industry in the United States." *Quarterly Journal of Economics*, 1900, pp. 143 and 475.

ing was becoming cheap and abundant. About 1890 revolutionary changes had also taken place in the making of tin cans by automatic machinery. This improvement not only increased the demand for tin plate, but the demand for tin plate made in certain sizes. Welsh manufacturers were not always ready to meet these demands, and undoubtedly helped to foster the feeling in America that domestic producers should supply the commodity.¹ Technical progress in the manufacture of tin cans made many confident that American *entrepreneurs* would reduce the cost of tin plate through inventions and improvements. They saw that the existing processes of manufacture in Wales were crude, and believed the trade susceptible of many improvements. A review of the industrial situation about 1890 shows how a confluence of factors favored the establishment of the tin-plate industry in the United States. The largest market for the product in the world was becoming the leading steel community, and it was only natural that domestic manufacturers should strive to appropriate to themselves the home market for finished steel products. The high duty of 2.2 cents per pound imposed by the McKinley Act was only an expression of this industrial situation, but served as a great incentive to enter the manufacture and stimulated the growth of the industry. It is a common fallacy to attribute the American tin-plate industry to the McKinley Tariff. True, the inception of the trade followed this legislation, which was timely, but it resulted from the working of deeper causes of which the tariff itself was only an expression.

By the end of the period of inception, 1894, the industry had taken firm root in this country. No better proof of this statement is to be found than the fact that the trade grew more rapidly than ever after the duty of 2.2 cents per pound was lowered to 1.2 cents by the Wilson Act of August, 1894.² To be sure, there were temporary labor trou-

¹ *Iron Age*, August 28, 1890, p. 346; *ibid.*, February 19, 1891, p. 320.

² *Ibid.*, January 17, 1895, p. 111.

bles following the cut, but continued prosperous existence showed that the industry rested on firmer foundations than tariff schedules. In 1897 the Dingley Tariff raised the duty to 1.5 cents per pound, but under the competitive conditions prevailing, this change was purely nominal.

The higher duty, however, proved to be very convenient for the American Tin-Plate Company, which was formed in December, 1898, and proceeded to raise the price of tin plate about two dollars per box. Moreover, the figures of production show that the rate of growth abated while the combination was enjoying its complete monopoly.

With the entrance of independent firms the growth of production has been extremely rapid. In 1909 the Payne-Aldrich Tariff Act reduced the duty to 1.2 cents per pound on the recommendation of manufacturers (strange though it may seem), but this again was purely a nominal change. The existence of the duty, however, sheltered the policy of price agreements. Since 1911 there has been competition both as to production and as to price; not cut-throat competition, but "rational" or "gentlemanly" competition among "decent" men.

Surveying this history as a whole, the continuous and rapid growth of the industry is the outstanding feature. In the present century the annual tonnage production has increased nearly two hundred per cent to approximately 1,000,000 tons, and the United States has become the greatest producer in the world. Surely tin-plate making found a favorable environment in this country. It is small wonder that the reduction of the duty to 15 per cent *ad valorem* by the Underwood Act of 1913 is a matter of indifference to manufacturers.

Turning now from the figures of output which demonstrate so well the growth of the industry in America, we may examine the three reports of the United States Censuses of 1900, 1905, and 1910, which set forth the details of the expansion. The Census Bureau divides the manu-

facture of tin and terne plate into two processes, the rolling of the steel and the dipping, and presents figures for both branches. The following table summarizes the growth of the industry as a whole, and also contains reports for black-plate mills and dipping plants as separate units:—

Growth of tin and terne plate industry in the United States

	1899 ¹	1904	1909 ²	Per cent of increase		
				1899-1904	1904-1909	1899-1909
Number of establishments.....	66	44	54	-33.3	-22.7	-48.5
Rolling black plate and dipping....	35	27	27			
Rolling black plate and not dipping..	9	8	3			
Dipping only.....	22	9	4			
Wage-earners.....	14,926	17,164	18,956	15.8	10.4	27.9
Capital.....	\$27,323,302	\$31,984,487	\$42,098,404	17.1	31.6	54.1
Expenses of production.....	\$36,025,354	\$39,339,943	\$61,078,213	9.2	55.3	69.5
Wages.....	\$10,288,061	\$10,559,723	\$14,724,613	2.6	39.4	48.1
Materials.....	\$24,414,510	\$26,028,250	\$42,430,430	6.6	63.0	73.3
Value of tin and terne plate.....	\$31,284,145	\$34,549,542	\$45,815,146	10.4	32.6	46.4

¹ 12th Census of the United States. Report on Manufactures, 1899, p. cxxiii.

² 13th Census of the United States. Report on Manufactures, 1909, vol. x, pp. 272-80.

The industry is concentrated in the steel district, the works being located around Pittsburgh, in the southeastern part of Ohio, and the northeastern part of West Virginia.

Black-plate mills

	1899	1904	1909	Per cent of increase		
				1899-1904	1904-1909	1899-1909
Number of establishments..	44	35	50	-20.5	-14.3	-31.8
Wage-earners.....	11,155	12,317	13,604	10.4	10.4	22.0
Capital.....	\$30,673,255	\$21,171,248	\$31,103,596	2.4	46.9	50.5
Number of hot mills	332	313	335			
Number of cold mills	294	272	268			

Tin and terne plate dipping

	1899	1904	1909	Per cent of increase		
				1899-1904	1904-1909	1899-1909
Number of establishments..	57	36	51	-36.8	-13.0	-45.6
Wage-earners.....	3,671	4,847	5,352	32.0	10.4	45.9
Capital.....	\$6,650,947	\$10,813,239	\$10,994,813	62.6	1.7	65.3
Dipping sets.....	583	619	573			

The striking fact presented by the table is the large decrease in the number of establishments engaged in the industry. Since the formation of the American Tin-Plate Company the manufacture of tin and terne plate has been concentrated in fewer and better plants. In 1898 the combination acquired thirty-nine plants, but to-day it operates about twenty. Undoubtedly this represents a conservation of capital and energy. The number of wage-earners has increased from 14,826 to 18,956 in 1909, and to-day is probably about 21,000. Figures for capital value, expenses, and value of finished product all show increases of fifty per cent or more.

The concentration of the manufacture of black plate in fewer and larger plants, a development common throughout the iron and steel industry to secure higher efficiency, is shown by the decrease in the number of plants.¹ Supplementing the census figures with some for earlier years, we note that there were, in October, 1895, 37 plants rolling black plate in 159 hot mills, there being on the average 4.3 mills per plant.² In June, 1898, 44 were in operation and possessed 253 hot mills, or on the average 5.7 mills per plant.³ Since then the number has declined. There were 47 plants in 1899 and 332 hot mills, or 7.5 mills per plant. In 1909, 30 establishments possessed 335 mills. Thus the average number of hot mills per plant had increased to 11. Since 1909 there has not been a large increase in the number of hot mills; in 1911 there were 380 and to-day there are 363 in operation.⁴ The theoretical average plant con-

¹ *Iron Age*, October 14, 1897, p. 18. Movement toward larger plants noted.

² *Ibid.*, October 10, 1895, p. 747.

³ *Ibid.*, July 7, 1898, p. 27.

⁴ *Ibid.*, January 4, 1912, p. 63. Figures for 1914 from Mr. E. V. B. Luty, correspondent of *Iron Age* and authority on sheet and tin-plate industries. At the end of 1914 there were 378 hot mills, of which independent manufacturers controlled 176, or 46 per cent. *Iron Age*, January 7, 1915, p. 10.

tains about 12 hot mills, or twice the number of the early years of the industry's growth.

The growing tendency to consolidate the two branches of the industry is apparent from the decrease in the number of firms engaged only in dipping, and the decrease of the number making black plate only. In the early years of the industry profits were large in the dipping business and many firms tinned imported black plate. Colonel Ira Ayer, special agent of the United States Treasury Department, compiled a series of statistics to show the amount of foreign black plate tinned in this country. In the fiscal year, 1891-92, 31.88 per cent of the production of tin and terne plate in the United States was made from foreign black plate, but in 1896-97 only 0.01 per cent. The imports of black plate into this country had practically ceased.

*Production of tin and terne plate*¹

<i>Fiscal year</i>	<i>Per cent of American black plate</i>	<i>Per cent of foreign black plate</i>
1891-92	68.12	31.88
1892-93	43.68	56.32
1893-94	61.74	38.26
1894-95	82.85	17.15
1895-96	98.62	1.38
1896-97	99.99	0.01

The rapid disappearance of foreign black plate was due in part to the discrepancy in the Wilson Act between the duty on tin plate and that on black plate.² On tin plate the import duty was 1.2 cents per pound, and on black plate 1.225 cents per pound. This difference encouraged the use of domestic black plate, and helped to diminish the number of dipping firms. In October, 1895, there were thirty-two plants engaged in tinning, but in July, 1898,

¹ *Iron Age*, January 13, 1898, p. 9.

² *Ibid.*, August 23, 1894, p. 313; September 6, p. 405.

the number was only twenty-three.¹ When the trust was formed, there were twenty-two dipping plants, but they dropped out rapidly when the combination cut off their supply of black plate. Only nine firms remained in 1904, and four in 1909. As the number of tinning establishments has declined, the number of rolling mills not engaged in dipping has also diminished greatly. There were nine such plants in 1899, but only three in 1909. This integration of processes is a natural development to secure higher efficiency, and the consolidation of the two branches of the industry is now practically complete.²

There is no doubt that the concentration of the industry in fewer and larger plants and the consolidation of its constituent processes have secured many economies and materially reduced the cost of manufacture. The output of the industry has increased nearly two hundred per cent in the past fifteen years, while the number of firms engaged has decreased nearly fifty per cent. Moreover, the increase in the number of hot mills has been small; the number of cold rolls and tinning sets has actually decreased; and the total of work-people employed has increased only about fifty per cent. Better organization and technical progress have increased the industry's efficiency remarkably.

Imports and exports

Since the primary aim of this chapter is to present a succinct account of the growth of tin-plate manufacturing in America, it is necessary to trace the course of imports and exports, although these trade developments will be considered more fully later.

As the American industry expanded, imports from Wales fell off steadily. The following table gives a complete set of figures of imports from 1890 to the present day: —

¹ *Iron Age*, October 10, 1895, p. 747; July 7, 1898, p. 27.

² *Thirteenth Census of the United States*. Report on Manufactures, 1909, vol. x, p. 273.

*Imports of tin and terne plate into the United States
from Wales*¹

<i>Year</i>	<i>Tons</i>	<i>Year</i>	<i>Tons</i>
1890	321,109	1903	50,674
1891	325,143	1904	71,862
1892	278,478	1905	63,050
1893	255,603	1906	61,518
1894	226,880	1907	58,920
1895	222,901	1908	60,602
1896	113,049	1909	64,446
1897	85,472	1910	73,619
1898	65,338	1911	13,997
1899	63,546	1912	2,135
1900	58,040	1913	21,000
1901	75,822	1914	15,529
1902	65,142		

Until 1896 the Welsh product dominated the American market, but in that year the domestic production (160,-362 tons) exceeded the imports for the first time. By 1898 the Welsh product had been driven from the domestic market, but continued to be imported by large canning interests, such as the Standard Oil Company, who found it profitable to purchase the cheaper Welsh tin plate for their export trade. Upon reexportation, ninety-nine per cent of the duty was refunded under the provisions of the drawback arrangements on reexported goods, and thus Welsh tin plate for this purpose was practically duty-free. While the price of the Welsh product was below that of the American, Wales retained this portion of its old market and sent from 50,000 to 70,000 tons annually to the United States. In 1911, however, American manufacturers appropriated this reexport trade and have held it since. Imports were almost nil in 1912, and in 1913 amounted to only 2 per cent of the domestic production. A portion of the imports consists of specialties.

Not only have the American producers captured the domestic market and the reexport trade; they have also

¹ Parliamentary Documents. *Trade and Navigation Accounts, 1890-1913. Reports on the Commerce and Navigation of the United States.*

extended their operations to the neutral markets of the world. The following table shows the exports year by year since 1899:—

Exports of tin plate from the United States¹

<i>Year</i>	<i>Tons</i>	<i>Year</i>	<i>Tons</i>
1899	102	1907	20,000
1900	159	1908	17,000
1901	700	1909	5,000
1902	1200	1910	13,000
1903	800	1911	61,466
1904	4,000	1912	81,694
1905	11,000	1913	74,710
1906	12,000	1914	60,632

The principal places to which exports are made are Canada and Asia. In 1911 the United States exported about 22,000 tons to Canada and the Welsh 12,000 tons, although the latter had been exporting over 20,000 tons to Canada annually. In 1912 the Welsh imports fell off still more to 7038 tons and in 1913 were 9494 tons; in 1912 the United States sent 45,941 tons to Canada. Of course it is true that Americans have dumped their surplus product to a certain extent into Canada, and we shall have to inquire further into this question in a later chapter. The important consideration now is the entrance of Americans into foreign markets for the sale of a product whose manufacture has been established less than a quarter of a century, and the significance of this development as regards the position of the American tin-plate industry.

Welsh tin-plate industry since 1890

The loss of the American market was a staggering blow to the Welsh industry. For ten years after the hostile legislation of 1890 the trade suffered from abject depression.²

¹ *Reports on Commerce and Navigation of the United States, 1899-1911. Metal Market Year-Book, 1914.* Eighth year. Published by *The Ironmonger*, London.

² F. L. McVey in Ripley, *op. cit.*, p. 303. *Iron Age*, June 6, 1901, p. 11. *Iron and Coal Trades Review*, London, May 2, 1901.

Hope for future prosperity lay in the development of new markets, but the many firms of South Wales did not seem able to combine for a common end. There were many small plants scattered throughout South Wales, and a large number were old and inefficient. These demoralized the trade and prevented concerted action to improve conditions. Work-people believed that a restriction of output would benefit all concerned and they were willing to concur in general shut-downs. As exports diminished, nearly half of the hot mills became idle and many workmen emigrated to America. The table presented below shows the course

Welsh tin-plate industry

Year	Exports ¹ (tons)	No. of works open	Total	Hot mills ²		No. of work- people ²	Production (tons)
				Active	Idle		
1889	430,650		500	500		25,000	663,000
1890	421,797					29,000	
1891	448,379						
1892	395,449						
1893	399,172						
1894	353,928						
1895	366,120		500	287	213		
1896	266,763	89	492	328	164		
1897	271,230	86	484	325	159		
1898	250,953	64	359	314	45	16,091	
1899	256,378	78	450	313	37	20,554	
1900	272,373	69	396	324	72	16,200	
1901	271,320	77	443	378	64	18,900	
1902	312,206	75	424	387	75	19,300	
1903	292,800	68	389	353	36	17,600	
1904	359,634	75	417	397	20		
1905	354,864	77		413 ⁴		20,666	
1906	394,802	72		377			
1907	465,328	75		390			529,000
1908	402,861	75		391			
1909	439,747	74		401			
1910	482,861	75		428			
1911	484,355	79		476			
1912	480,920	74		466			
1913	494,921	74		453		21,000	{ (estimate) 700,000

¹ Parliamentary Documents. *Reports of Trade and Navigation*.

² *Labour Gazette*. Published by the Board of Trade, London.

³ Parliamentary Documents. *Census of Production*.

⁴ From 1905 on, the figures give the average number operated each year.

of the export trade since 1890, the number of hot mills at work and idle, and the approximate number of work-people engaged in the industry. Unfortunately the figures for annual production are not compiled, but the "Census of Production" states the output for 1907.

This table tells a tale of the vicissitudes of business and shows how Wales has at last regained the position it held in 1890. After ten years of severe depression, during which prices were low, labor troubles frequent, and wages from seven to twenty-five per cent below the standard scale, doughty little Wales, by taking advantage of the ever-increasing demand for tin plate, has gradually opened up new markets in Germany, the Netherlands, France, Rumania, Russia, Portugal, the British East Indies, Australia, and other countries all over the world, and built up another huge export trade. Unlike the American industry, it depends for the most part on foreign markets. In 1907 its total production was 529,000 tons, and exports 465,328 tons, or eighty-five per cent of the output. This trade, however, is much more secure than that of 1890, for no one market consumes seventy-five per cent of the exports.

The industry reached its nadir at the end of the last century; since it has recovered year by year. Many of the old and inefficient plants have been ousted from the trade, and modern establishments have been erected. To-day there are some seventy-five firms in the field, a somewhat smaller number than in the days of Welsh monopoly. The number of hot mills is also somewhat less than the figure of 1890, and the estimate of the number of work-people has decreased from sixteen to twenty-four per cent according to the figure accepted. It is probable that the present output is about equal to what it was in 1890. English "tariff reformers" used to point to the Welsh tin-plate trade as an example of an industry ruined by free trade, but they must look for other arguments to-day. The ever-growing

demand for tin plate all over the world has enabled Wales to retrieve her fortunes.

The Welsh industry presents several significant comparisons with the American trade. There are more than twice as many producing firms in Wales as there are in America. The tendency to concentrate production in fewer and larger plants has not taken hold in Wales because of the difficulty of forming combinations. It is said that the small size of the average Welsh firm is due to historical causes.¹ When the trade began in Wales, manufacturers relied on water power and so could install only four or five hot mills. Having started that way, they have not deviated from their course. Consequently the number of hot mills in the theoretical average plant remains about six, whereas in America it is now twice that number. The presence of a large number of small plants makes it difficult to effect combinations, as we shall see in a later chapter. Growth of large-scale business in America has undoubtedly secured great economies in the direction of more machinery and better utilization of it, and improved facilities for handling materials.

A comparison that illustrates effectively the contrast between the two great producers of tin plate is made in the following table:—

Year	Production		Hot mills—av. no. in op.		Work-people	
	Wales	U.S.A.	Wales	U.S.A.	Wales	U.S.A.
1907	529,000	514,000	390	{ 374 (total no.) 229 (av. no. op.)	20,000	18,000
1912	700,000	962,000	466	{ 360 (total no.) 270 (av. no. op.)	21,000	21,000

In 1907 the quantities produced in Wales and the United States were about equal, but the latter country employed fewer work-people and operated a much smaller number of mills. The production in Wales in 1912 was probably

¹ R. B. Thomas, of Richard Thomas & Co., Ltd. London.

nearer 600,000 than 700,000 tons, and about 300,000 tons less than the output in America. Yet the number of hot mills operating in Wales exceeded the total in existence in America by over one hundred. The number of work-people was about the same in both countries. That this country produces tin plate with a less expenditure of energy than Wales seems undebatable.¹

Tin-plate industries in Germany, France, and Italy

This study deals primarily with the tin-plate industries of Wales and the United States, for these two countries are the only great producers in the world. There are small outputs in Germany, France, Italy, and Spain, but together they probably do not produce 150,000 tons. The following table shows recent outputs in these countries and also the imports from Wales:—

*Production of tin and terne plate*²

Year	Germany		France		Italy	
	Production *	Imports	Production	Imports	Production	Imports
1909	55,400	35,446	39,713	17,206	35,880	
1910	57,100	39,056	41,449	14,977	27,820	
1911	64,800	42,747	37,471	31,841	25,562	
1912		41,379	40,629	31,904	28,916	
1913		34,739		21,318		20,418

* *Statistisches Jahrbuch für das Deutsche Reich*. Berlin, 1913, p. 85.

There was some tin-plate production in France and Germany in 1890.² Germany produced 21,348 tons, and in 1908 had an output of 48,334 tons. During the past five years Germany has imported about 40,000 tons annually, almost as much as the yearly production. The French output is 40,000 tons or so, and the imports fluctuate between 20,000 and 30,000 tons. Italy manufactured 2918 tons in

¹ Mr. J. H. Jones, Secretary of the Tin-Plate Workers' Union, Swansea, Wales, has reached the same conclusion. See his article in *Economic Journal*, June, 1913, p. 182.

² O. Vogel, *Stahl und Eisen*, vol. xxix, pp. 1097-1107. *Ironmonger, Metal Market Year-Book*, 1914. Figures are in tons.

1898, and has plodded along until its output is about 30,000 tons, with importations somewhat less. These small amounts have no influence in the world's markets.

In Germany, France, and Italy duties on tin and terne plate vary with the gauge. In Germany the import duty per hundredweight varies from 60 to 66 cents, equivalent to about 20 per cent *ad valorem* under present prices. The duty in France ranges from \$1.17 to \$1.27 per hundredweight; and in Italy from \$1.36½ to \$1.75½.¹ The French and Italian duties are very high, yet the imports practically equal the domestic production. Perhaps if they had had large domestic markets for tin plate, these countries also would have established a great industry as the United States has done.

In our brief survey of the growth of the tin-plate industry since 1890 we have aimed to tell succinctly the principal facts and to present the trend of developments in Wales and in America. Our story has followed the expansion of the trade in a new environment, where it has flourished and grown so rapidly that, to-day, the United States is the leading producer of the world. Our tale has also included an account of gallant little Wales's recovery from her misfortunes of 1890. With these events in mind we may turn to a detailed examination of the various aspects of the industry's growth at home and abroad, and seek to understand the factors that have promoted it. First, technical development must occupy our attention, for progress in the conduct of any trade is the motive force of its prosperity.

¹ Information furnished by the British Board of Trade.

CHAPTER III

TECHNICAL DEVELOPMENT SINCE 1890

WE have already described the process of tin-plate manufacture as it was carried on by the Welsh in 1890. In this chapter we are to trace the technical development of the industry in Wales and in the United States, to note the contributions of each to the advance of technique, and finally to estimate their relative positions in regard to methods and equipment.

At the risk of repetition we may recapitulate the various processes and then describe the improvements that have been made in each. First, the sheet bar is cut into slabs and then rolled into packs of laminated sheets. These are sheared to size and then opened. To clear them of oxide of iron they are pickled. Annealing makes them tough, and cold rolling gives them a good surface. All these processes prepare the sheets to receive a coating of tin.

Rolling

When tin-plate making started in the United States, *entrepreneurs* had to rely upon Welsh methods and Welsh labor until the work could be learned and machinery adapted to American conditions.¹ Progress was slow during the first few years while the Americans were learning, especially because they did not take readily to the light Welsh machinery. Breakages were frequent and output small. So American engineers pursued a new line of development in the rolling process.

¹ *Report of the United States Industrial Commission, 1900, vol. 1, testimony by D. G. Reid, pp. 878-79.*
Iron Age, September 13, 1894, p. 430.

The first innovation in the United States was an increase in the size of the hot rolls, which in Wales had been nineteen inches in diameter and twenty-four inches in length.¹ The Americans quickly realized the advantage of rolls of larger diameter and length, and so increased the diameter to twenty-four inches and the length to thirty-two inches. This change increased the weight of a stand of rolls, for, while the Welsh stands weighed some seven tons, the American type was some eleven tons in weight. The chief advantages of the heavier stands lie in the greater heat-radiating surface, which permits of a greater product being made, and the increased pressure which enables the packs to be rolled to greater length. Furthermore, the larger body of metal heats and cools more slowly than the smaller, thus maintaining a steadier temperature. The introduction of larger rolls was general in America previous to 1895. Since then there have been further increases in the size of the rolling mills, until the rolls are twenty-eight inches in diameter and the stands weigh fourteen tons.

A very important change in the conduct of the trade resulted from the increase in the size of the rolling machinery. In the Welsh practice two stands of rolls are used in the mills, one for roughing, the other for finishing. These stands are operated on the same shaft and are in continuous operation, though used alternately. To eliminate this waste of machine energy and to augment the use derived from a single stand of rolls, the Americans abandoned the Welsh practice and concentrated the rolling on one huge stand.

Some Welsh engineers maintain that the Americans introduced nothing new in this change, but merely applied the methods of sheet-rolling to tin-plate making. Although

¹ *Tariff Hearings*, vol. 2, Ways and Means Committee, 60th Congress, 2d Session, 1908-9. House Doc. vol. 140, p. 1900.

Iron Age, November, 1895, p. 1092.

this claim may be true, credit must be given to the Americans for the new application of old ideas, for their innovation has proved eminently successful and has been followed in Wales, as regards the increase in the size of machinery. The one-stand practice, however, has not found favor in the older country. Manufacturers assert that the black plate rolled on two stands and subjected to five heatings and five rollings is superior to the product of the other method, yet consumers find no difference in quality. Rolling on two stands of rolls persists in Wales, although it involves the loss of much machine energy and does not approach the American method in efficiency.

In the United States an increase in the number of men employed in a mill crew has accompanied the use of heavier machinery. The mill crew has always consisted of four men in Wales, the roller, doubler, heater, and catcher. In this country the practice has grown up of employing helpers for three of these workmen. There are the roller's helper, the doubler's helper, and the heater's helper, who increase the mill crew to seven men. The wages of these additional workmen are paid from the tonnage rates already established for hot-mill labor.

A threefold increase of output per mill per turn of eight hours has resulted from the intensive use of large machinery. In the early nineties thirty boxes constituted a good turn, but to-day the average output per turn in American plants ranges from one hundred and twenty to one hundred and thirty boxes. The Welsh average turns yield forty to forty-five boxes.¹ The American industry's growth during the past fifteen years has been due, not to any large increase in the number of hot mills, but primarily to the augmenting output per mill. To illustrate this increasing efficiency figures are presented to show the average

¹ Parliamentary Documents. *Report on the Manufacture of Tin Plates*. 1912, Cd. 6394, p. 5.

Ironmonger (London), December 27, 1913, p. 50.

number of mills operated during several years, together with the total product: —

*Output per mill*¹

Year	Average number of mills operated	Product (tons)	Average per mill (tons)
1904	231	458,000	1,933
1905	229	493,500	2,155
1906	264	577,562	2,188
1907	229	514,775	2,248
1908	212	537,087	2,534
1909	236	611,859	2,593
1912	270	962,000	3,400

Ten years ago the annual average per mill was less than 2000 tons; to-day it is approaching 3500 tons. In considering these figures it must be remembered that tin plate is a light product. Compared with the output of a rail mill, the annual average would seem ridiculously small, but 3500 tons of tin plate mean about 16,856,000 square feet in area. Many millions of cans can be made from that amount. In Wales the average annual output per mill is probably less than 2000 tons.

The actual operation of rolling in America is different from the Welsh practice and entails four heatings of the steel instead of five.² The red-hot slabs are withdrawn from the furnace in pairs and passed alternately through the rolls until each has had three passes, when the catcher matches the two slabs and returns them together. Then the rollerman, slacking back the screws a bit, feeds them through the rolls together. They are returned to the furnaces as one piece of two layers. After the second heating and rolling, the pack is doubled and becomes a piece of four layers, and after the third operation, of eight. In the fourth operation, the pack is rolled to length, and thus is

¹ *Iron Age*, January 6, 1910. *Ibid.*, January 1, 1914.

² *Twelfth Census of the United States*, 1900. Report on Manufactures, 1899, p. cxxiii. Description of process by W. C. Cronmeyer, manufacturer.

finished by four heatings and rollings, whereas the old method requires five. To roll the standard size (20 x 14 inches) by the Welsh method the sheet bars are cut into slabs of twenty inches, and when rolled to a pack of eight layers, measures 20 x 42 inches. This pack cuts up into twenty-four sheets of the standard size. On the other hand, the Americans begin with slabs of twenty-eight inches in length and roll two together into an eight-layer pack measuring 28 x 60 inches. Thus, four heatings and rollings produce forty-eight sheets. Of course, Welsh manufacturers claim that they make a superior product, yet it is to be noted that the American tin plate has displaced the Welsh in the Canadian market. If it were inferior, it could not find favor as it does. One large Welsh manufacturer admits that the American tin plate is just as good as that made in his country.¹ Although the Welsh makers have followed the Americans in increasing the size of their machinery, they have never adopted the American method of rolling.

Since 1890 the advance in rolling steel products by mechanical mills has been marvelous.² Almost all finished steel products are now rolled automatically by wonderful machinery that has displaced skilled labor. In the case of a few products, however, mechanical rolling mills have not been able to supplant skilled workmen, and sheets and tin plates are among them. Consequently tonnage wages for sheets and tin plate are to-day very much higher than for products — such as steel rails and wire — that are mechanically rolled.³ Attempts have been made by engineers to introduce automatic rolling mills for black plate, but they have failed to displace the skilled hot-mill labor.

¹ R. B. Thomas, of R. Thomas & Co., Ltd. London.

² *Report on Conditions of Employment in the Iron and Steel Industry in the United States*. Prepared under the direction of C. P. Neill, Commissioner of Labor. 62d Congress, 1st Session, Sen. Doc. no. 110, 4 vols.

³ Commissioner of Corporations. *Report on the Steel Industry*, part II, January 22, 1912, pp. 30-35.

The latest automatic mill was introduced by Mr. C. W. Bray, of Pittsburg.¹ In 1903 he devised the Bray Mill, which rolled and doubled black plate automatically. Engineers and manufacturers were very optimistic about the success of this rolling mill, and the American Sheet and Tin-Plate Company introduced it in two plants, the Monongahela and the Sharon. It is claimed that the combination spent \$1,000,000 in the effort to secure a mechanical mill. The Bray Mill accomplished what formerly required two heatings, and two rollings, and a doubling, thus dispensing with half of the manual skill required in preparing black plate. Its output was enormous compared with that of previous methods, and amounted to seventy-five tons in twenty-four hours, or one half of the rolling of black plate for fifteen hundred boxes of the finished product.

The equipment consisted of a continuous heating surface for preparing the bars. Rolling was done by a mill of five stands, with tables. After the first rolling, the sheets were matched by an automatic matcher and then rolled in pairs through a continuous mill of two stands, with tables. Then the "pairs" were doubled automatically into "fours." Thus was accomplished automatically half of the work formerly done by manual skill. By the rapidity of the operation, the initial heating was sufficient for a reduction, which, on the old mill, required two heatings. After a thorough trial, however, it was found that mechanical rolling did not reduce costs, and the Bray Mill was abandoned.

There is a great deal of talk about the high cost of tin-mill labor, but when the factor of labor cost is graphically represented, it may be viewed in its proper light. To-day the mill-labor cost of a standard box of tin plate is about forty-four cents.² Now this box contains some 31,000

¹ *Iron Age*, January 7, 1904, p. 86; January 21, p. 28; December 31, 1908, p. 1077.

² About thirty per cent of total hot-mill cost.

square inches of tin plate, and thus the skilled-labor cost of over five square feet is only one cent. If tin-mill tonnage rates were paid for steel rails or structural shapes, the labor cost would be enormous, because they are large-sized products. But when the nature and uses of finished tin plate are considered, labor cost is no more important for it than for steel rails or structural shapes. Think of the pails and cooking utensils that can be purchased for five and ten cents. Their labor cost is insignificant. The labor cost of the tin plate in a tin can is inconsiderable. When one examines the problem in that light and considers the labor cost from the point of view of the nature and uses of tin plate, one sees that the high tonnage rates for rolling black plate are not so high after all. This is one of the fundamental reasons for the survival of skilled tin-mill labor. Another is that the rolling of tin plate is a unique operation and can be reduced to a mechanical process only with great difficulty. The continual heating and doubling require elaborate mechanical devices, and the operation as a whole requires a mill of great power. Balancing costs, the automatic process cannot, or, at least, has not yet, displaced the hot-mill labor. Manufacturers express the belief that automatic mills will never supplant the present method of rolling. Of this much we may be sure, that if ever mechanical rolling is introduced, it will be in America first.

Another experiment in rolling-mill operation was made in 1898 at the Monessen Works in Pennsylvania, where a system devised by Mr. W. H. Donner was established by the American Tin-Plate Company.¹ It consisted of a complete rearrangement of the rolling process so as to obtain more continuous and hence more efficient operation. As we have seen, one or two stands of rolls were utilized in American and Welsh practice; the Monessen system included five as the unit of operation. On the first two stands all the breaking-down of the sheet bars was to be done; on

¹ *Iron Age*, October 10, 1901, p. 10.

the third stand, "pairs" were to be rolled; on the fourth, "fours"; and on the fifth, "eights." The essence of this scheme was to have each stand of rolls always doing the same work and doing it continuously. Moreover, four series of sheet bars instead of one would be in the process of rolling simultaneously.

Following is a description of the plan of operation. Into one of the furnaces opposite the first two stands of rolls is charged a "heat" of sheet bars. When red-hot they are "roughed" on the first stand and then reheated in the furnace of the third mill. Meanwhile, a second "heat" of sheet bars is charged into the second of the furnaces opposite the roughing stands. Thus the first operation ends with a series of bars ready for "roughing," and a series of once-rolled sheets ready for rolling on the third stand. The latter are withdrawn in pairs, rolled and doubled, and then charged into the furnace of the fourth mill. Meanwhile, the second "heat" of bars is roughed, and the third series charged into the furnace of the first mill. The next operation is to roll the "fours" on the fourth stand and to send them to the last mill; to roll the second series (now "pairs") on the third stand; to rough the third series; and to charge the fourth into the roughing-mill furnace. The next step in the process is to finish the first series (now "eights") in the fifth mill, while the second is rolled and doubled into "eights" on the fourth stand, the third into "fours" on the third, the fourth "roughed," and the fifth charged for heating. In this way each stand of rolls is always doing the same sort of work, and the process goes on in a regular and continuous manner.

This system of rolling has not come into general use. Engineers and manufacturers maintain that the rolling of each pack on five different stands of rolls makes the black plate uneven, for each pair of rolls gives the pack a different "set." Moreover, it is claimed that a large number of "wasters" results from the method. At Mo-

nessen, where the system has been practiced since 1898, the workmen did not work under the "Amalgamated Scale of Wages."

In the Welsh hot mills the doubling and shearing machinery is operated from the main shaft of the rolls and hence is in continuous operation, though used intermittently. American plants have departed from this practice and have installed motors for each machine.¹ Thus the doublers and shearers are in operation only when they are used. The Welsh method wastes much machine energy. Some firms in this country are installing new patent doublers to eliminate part of the skilled tin-mill labor. They expect to reduce tonnage wage payments ten per cent.

To-day the American hot mill presents a striking contrast with the Welsh. It is the difference that distinguishes all American activities from those of other peoples — large-scale operations. The mill machinery is bigger and better utilized. More men are engaged in the work. Traveling cranes pass overhead to transfer materials and to change rolls. Trucks and jib cranes, such as one sees in Wales, have long since been abandoned. Some American plants have mechanical stokers to control the furnaces, and have cut down labor expenses and economized coal consumption. All these improvements have enabled the Americans to advance rapidly and to establish better and better records of output. In cutting sheet bars into slabs for the hot mills, American plants have installed rolls that take the bars directly to the bar shears and feed them, three and four at one time, to the cutter.

Shearing

The laminated packs of sheets pass from the rolling mills to the shears to be cut to the desired size. The old-time "crocodile" shearing machines, still in use in Wales,

¹ *Iron Age*, November 3, 1898, p. 5. Change had already been effected to conserve engine power.

are operated from the main shaft of the hot mills.¹ The shearmen have to be skilled to take advantage of their movements. A new style of machine is in use in the United States. It consists of a vertical or gate knife, and is set in motion by the operator, who presses a lever with his foot. The workman does not need special skill on this machine, for he controls its movements. On the contrary, the Welsh shearmen have to be trained to synchronize their operations with the movements of the "jaw" shears. It is said that the ordinary workman can shear more packs on the "guillotine" shears in a given time than the skilled laborer can on the "alligator" type.² The improved squaring shears came into general use in the United States before 1895, and its introduction has been the cause of the fall in tonnage payments to the shearman from \$1.70 to \$.40. Some works in Wales use this style of machine.

Opening

Unskilled labor performs the opening of the packs after they come from the shears. In Wales women and girls have always done the work, but men are employed in this country. Sometimes women open taggers' tin. In the Welsh works two or three women are employed for each mill, and in a day of eight and one half hours each opens from 45 to 60 boxes.³ Two men are employed for each hot mill in this country, and in a day of eight hours open the output of three turns, or about 350 boxes. The work is not particularly hard.⁴

¹ Parliamentary Documents. *Report on the Manufacture of Tin Plates*, 1912, Cd. 6394, p. 6.

² *Engineer* (London), 1895, p. 437.

Ironmonger (London), December 27, 1913, p. 50.

Twelfth Census of the United States. Report on Manufactures, 1899, p. cxxiii.

³ Parliamentary Documents. *Report on the Manufacture of Tin Plates*, 1912, Cd. 6394, p. 6.

⁴ Information furnished by manufacturers.

Pickling

For pickling black plate the Americans early adopted improved automatic machinery. When the industry first started, many plants used the Grey Machine from Wales, but in 1892 the Leechburg Manufacturing Company introduced the Mesta Patent Automatic Pickling Machine, which has come into general use in America.¹ The Grey Machine consists of an overhead trolley from which cradles are suspended over two vats, one for vitriol and the other for water. The Mesta Machine is supported by a single base and consists of a great vertical cylinder, the plunger or piston of which supports three cross-arms that carry the cradles of sheets to be cleaned. There are two vats at the base of the cylinder, so placed that the cradles may be swung directly over them. By means of a patent valve controller the plunger can be given a vertical motion of ten to twelve inches, which raises and lowers the sheets in the bath at the rate of forty to fifty strokes a minute. Three series of plates are being packed, cleaned, and washed during each operation. When the sheets in the sulphuric acid are thoroughly cleaned, the cross-arms revolve and carry them to the water bath. At the same time the arms carry sheets from the water bath to be unloaded, and another cradleful to the vitriol to be cleaned. In some plants the cradles are so constructed that the bottoms may be dropped out to discharge the clean sheets. This Mesta Machine is more efficient than the Grey and dispenses with the labor of pushing the heavy cradles from vat to vat.

In Wales, where the Grey Machine is used, a six-mill plant requires four men, two picklers and two wheelers, and ten to twelve women and girls. The average hours of employment are eight and a half to nine hours per day and six on Saturday. An average of eight hundred boxes

¹ *Iron Age*, April 20, 1893, p. 894.

passes daily through the black pickling process, and an equal number through the white pickling.¹

Common laborers, generally foreigners, do the pickling in the United States. Statements about the work accomplished with the Mesta Machine depend upon the size of the plant. In one works of twenty-two mills about seven thousand boxes pass through the black pickling every day, and an equal number through the white.

Annealing

In the annealing department the Americans have made noteworthy advance, and the Welsh admit that they will do well to follow the innovations made in this country. Here the manufacturers have improved the construction of furnaces, and have eliminated manual labor formerly employed in charging them. Vertical furnaces were introduced in some plants in 1894.² These furnaces, heated by gas, have circular removable tops which may be picked up by the traveling crane when they are to be charged. Then the crane picks up the annealing pots, and traveling to a position over the furnace lowers them and afterwards replaces the cover. One man aided by a boy can carry on the operations of annealing with this equipment, whereas six men at least are required for the arduous task of charging horizontal furnaces by means of a lever truck. To-day a six-mill plant in Wales gives employment to eleven men who charge the furnaces by the carriage method.³

The vertical furnace is one illustration of the advance made by Americans in the annealing process. Other improvements, common before 1900, dispensed with the

¹ Parliamentary Documents. *Report on the Manufacture of Tin Plates*, 1912, Cd. 6394, p. 6.

R. B. Thomas. *Proceedings of the Institution of Mechanical Engineers*, 1906, p. 489.

² *Iron Age*, January 25, 1894, p. 154.

Ibid., March 26, 1896, p. 773.

³ Parliamentary Documents. *Report on the Manufacture of Tin Plates*, 1912, Cd. 6394, p. 7.

manual labor employed in charging horizontal furnaces.¹ The electric charger consists of a long carriage that runs into the furnace on a track. Its top, carrying the annealing pots, is so arranged that it can be raised and lowered. The pots are placed on its top, which is in its raised position, and in such manner that the flat bottoms of the stands rest on the top of the carriage, while their legs protrude downwards over the sides. After the loaded carriage is run into the furnace, the top is dropped so that the pots are left standing in the furnace, and then the carriage is withdrawn. These electric chargers are moved by power from the electric crane or by a separate motor.

Another charging device is a long arm with a counterpoise at one end and a pot at the other. The crane picks the arm up near the middle and swings the annealing stand into the furnace, to deposit it in any position desired.

A common method of charging annealing furnaces is by means of horizontal pulleys. The pots are placed on tracks running into the furnace or on steel rollers. A chain, attached to the stands, runs over a pulley in the furnace and back to the stands, where the crane picks it up and pulls the pots into the furnace. When the annealing is finished, the crane draws out the boxes.

Traveling cranes and electric chargers are not common appliances in even the best-equipped Welsh works. Some of the large and modern plants have them, but most of the establishments have retained forked carriages and a staff of men to do the annealing.² The employment of machinery in the United States facilitates the use of larger furnaces and annealing pots than are in vogue in Wales.

When a plant employs ten or eleven men to work in the

¹ *Twelfth Census of the United States. Report on Manufactures*, p. cxxiii.

² *Parliamentary Documents. Report on the Manufacture of Tin Plates*, 1912, Cd. 6394, p. 7.

R. B. Thomas. *Proceedings of the Institution of Mechanical Engineers*, 1906, p. 499.

annealing department, it encounters the difficulty of keeping these workmen busy. The annealing does not occupy all their time, and they sit idle unless other work is open to them. American manufacturers could not afford to maintain this staff of annealers, who worked only intermittently, as they could not provide other work for them. So the necessary consequence in this country has been the elimination of manual labor in the annealing department.

Cold-rolling

The Welsh method of cold-rolling is essentially the same to-day as it was in 1890, except that the sets of cold rolls are now arranged in tandem fashion as in America. Boys and girls still do the work in this department, the larger boys feeding the rolls and the little children carrying the sheets to and fro. This child labor is very cheap, the wages ranging from 1s. 6d. (36 cents) per day to 2s. 2d. (52 cents).

American manufacturers have eliminated two thirds of the manual labor formerly done in cold-rolling, and have made this a mechanical process.¹ Electrically driven conveyors have been installed between the sets of cold rolls to carry the sheets from one pair of rolls to the next. There are special devices by which a sheet, after it has passed through the first or second pair of rolls, can be thrown out, if its edge has been turned, or if it has been pinched, for such a plate would seriously injure the surface of the rolls, were it allowed to pass through them. One such arrangement consists of a lever which a boy throws when he sees a defective plate, so as to cause it to pass out of the line of feed. Not only does the mechanical process eliminate labor, but it also speeds up the cold-rolling. Only one firm seems to have adopted this device in Wales.² Child labor is so cheap that it prevents the introduction of machinery.

¹ *Twelfth Census of the United States, 1900*, p. cxxiii, ff. W. C. Crone-meyer.

² Parliamentary Documents. *Report on the Manufacture of Tin Plates 1912*, Cd. 6394, p. 8.

Tinning

Tinning, in 1890, was a manual process, requiring skilled workmen. But the Morewood patent for passing tinned sheets through a pair of revolving rolls, submerged in the boiling grease of the last pot of the five-pot system, was the beginning of a revolution in the process of tinning. Ultimately the principle of the submerged rolls was to be extended throughout the operation and to eliminate all hand labor, except the initial feeding, which was no longer to require special skill on the part of the workmen.

By the year 1890 various tinning machines were being experimented with in Wales, but their use was as yet very limited.¹ The five-pot method still held command of the field, principally because the workmen refused to accept changes in their long-practiced art. Tinning machinery meant that their skill would no longer be required, and it would also result in a large displacement of work-people. Complaints by manufacturers that workmen refused to adapt themselves to machine methods in tinning, cleaning, and polishing were common; they abound in trade journals and reports of the time.

Despite this reluctance to adopt machinery, to Wales must go the credit of devising the tinning machine. To be sure, the Americans have many types of machines and have added improvements, but they received the principle from Wales. The important consideration, however, is that the Americans were ready to take up the Welsh idea and to improve it so as to eliminate labor and to adapt the tinning process to conditions prevailing in the United States.

Two men, the tinman and the washman, and a boy, the riser, were employed at the five-pot dressers. The tinning

¹ R. B. Thomas, *Proceedings of the Institution of Mechanical Engineers*, 1906, p. 499.

B. Hammond, *Proceedings of the Iron and Steel Institute*, vol. VII, 1897, p. 24.

pots invented about 1890 dispensed with the washman. They were of two distinct types, the horizontal which had two pots of tin, and the vertical with a single pot. In 1882 Taylor and Leyshon had introduced a machine of the latter type, and devised the use of chloride of zinc as a substitute for palm oil in cleaning the sheets before tinning. The action of this tinning flux, as it is called, is much more rapid and effective than palm oil, so that instead of immersing the sheets in the flux, as in the oil, they are merely passed through a thin layer of flux floating on the surface of the molten tin. Then revolving rolls are submerged in the molten tin to regulate the coating and to convey the plates to the grease-pot, whence they emerge to be taken by the riser. In their opposition to these machines the workmen complained that the tinning flux was injurious to their health, and sought to prejudice consumers against the machine-coated tin plate by claiming that the flux would contaminate canned food products.¹

A general description of the construction and working of the two types of tinning pots will serve as an explanation of the tinning machine without going into the details of the various patents.

The horizontal machine contains two pots, the tin-pot and the wash-pot, the metal in the former being maintained at the higher degree of temperature. A cast-iron frame, penetrating a few inches below the surface of the molten metal, is placed inside the tin-pot and forms two divisions; the outer portion, or the flux box, contains a thin layer of zinc chloride, and the inner division forms a box (scruff box) in which are put the skimmings from the pot. A thin layer of oil on the surface of the metal prevents oxidation. A deep cast-iron frame, forming the grease-pot, surmounts the wash-pot and penetrates below the surface of the metal; it contains palm oil which floats on the surface of

¹ B. Hammond, *Proceedings of the Iron and Steel Institute*, 1897, vol. VII, p. 24 ff.

the molten tin. These pots are provided with curved guides and finely finished rolls, which conduct the plates through the process. The tinman feeds the plates one by one with a fork through the flux into the molten tin in the tin-pot. Here they are caught by a pair of revolving rolls and are taken by successive pairs through the wash-pot and grease-pot. Finally they emerge from the latter coated with tin. The speed of the submerged rolls regulates the coating.

The vertical tinning machine differs from the horizontal by lacking the wash-pot. It consists of a deep, narrow pot, capable of holding about three tons of molten tin, surmounted by a flux box at the front and a grease-pot at the back. The method of feeding the plates is the same, and curved guides and rolls convey them through the tin and grease.

Although tinning machines were introduced previous to 1890, they did not displace the old five-pot sets for years. Indeed, we read in a paper prepared in 1897¹ that the Morewood and Saunders five-pot sets are still in use in many works in Wales, and even to-day a few exist and are used for special brands of tin plate.

When the industry started in America many of the tinning sets were of the five-pot type prevalent in Wales, for in 1892, the Tinned-Plate Manufacturers' Association drew up a scale of wages based on hand methods.² The tinman, washman, and riser all figured in the scale. But even in that year tinning machines were being imported from Wales, while others were being manufactured in this country. According to a review of the American industry in 1895 tinning machines were coming into general use.³ Certainly machinery was in use throughout the trade by

¹ B. Hammond, *Proceedings of the Iron and Steel Institute*, vol. VII, 1897, p. 24 ff.

² *Iron Age*, March 3, 1892, p. 108.

³ *Engineer* (London), 1895, p. 459.

Iron Age, December, 1895, p. 1266.

1898.¹ The automatic machine eliminated skilled labor, which was scarce in America, and made it possible for an ordinary workman to conduct the whole operation.

The trade names of the various tinning machines in use to-day are many. In Wales there are the Jenkins, the Thomas, the Edwards, the Rogers, etc. Many firms make their own machines, which have no particular name. Representatives of American machines during the course of the trade have been the Buckman Automatic Tinning Machine, invented in 1892 and comprising a series of operations for cleaning, drying, and tinning;² the Jacques Pot; and the Lewis Double Tinning Machine. The latter increased the width of the pot so as to provide for the tinning of two series of sheets simultaneously.³ This development has had further extension, until "jumbo" machines with rolls sixty-six, seventy-two, and eighty inches wide, allowing the passage of three and four series of sheets, are in use. As in Wales, many firms construct their own tinning machines.

Tinning pots have displaced the washman. Mechanical conveyors for transferring the coated sheets from the tinning machine to the cleaning machine have ousted the "riser." In Wales the "ironman," a complicated mechanical device, is used a great deal. It consists of a set of clips attached to the end of a rod worked by a cogged quadrant. As the sheets emerge from the grease-pot the clips seize them and carry them to the branners. This device does not work so well as the simple conveyor that catches the sheets as they slide down inclined guides from the grease-pot. These mechanical conveyors have by no means ousted the "risers" entirely from the Welsh trade. In many works boys still transfer the sheets, and some plants use both boys and machinery.

¹ *Report of the Industrial Commission*, 1900, vol. I, testimony by D. G. Reid, p. 879.

² *Iron Age*, June 16, 1892, p. 1178. ³ *Ibid.*, September 15, 1898, p. 15.

In the United States the boy "riser" has practically disappeared. In the nineties some firms began to substitute mechanical conveyors, and by 1903 machinery was in general use.¹ The usual practice in this country to-day is to equip the tinning machines with mechanical risers and conveyors to take the sheets from the grease-pot to the cleaning machine. Thus a process that was still manual in 1892 is now carried on by automatic machinery. Of the three workmen who formerly tinned black plate, only one is left and he is not a skilled workman. The introduction of machinery has speeded up the process of tinning. Less than thirty boxes per turn was the average output by the manual method, while the large jumbo machines, now in such general use, tin seventy-five boxes in a turn of eight hours.² It is probably a safe conclusion that the American manufacturers exploited earlier and more completely the automatic methods for tinning black plate, especially because skilled tin-house labor was scarce and the high tariff stimulated them to produce the commodity as rapidly as possible.

Cleaning and polishing

Before the introduction of cleaning and polishing machinery in 1892, girls used to pass the tinned sheets through a heap of cleaning material, consisting of "shudes" and "sharps" (sweepings of flour mills), and then polish them with a pad of sheepskin. Both the Welsh and the Americans have contributed to the introduction of machines to supplant this hand labor. The branning machine generally in use in Wales for cleaning is a drum-shaped machine, containing slowly revolving arms that push the sheets through an absorbent mixture to remove the grease adhering to the surfaces. The polishing machine is a series of rapidly revolving rolls, covered with sheepskin, which

¹ *Iron Age*, January 7, 1904, p. 86.

² Information furnished by manufacturers.

clean off all dust and give the sheets a bright polish. Usually, the cleaning and polishing machines are connected so that the operations are continuous.¹

In the United States various machines have been introduced to increase the rapidity of the cleaning and polishing. In 1894 was invented the Record Tin-Plate Cleaning Machine, which consists of a large drum operated at high speed and containing in the periphery a large quantity of bran.² Within the outer drum are smaller ones carrying steel tapes that convey the sheets through the machine and allow the bran to brush their surfaces. In 1895 the Duplex Tin-Plate Duster, a very rapid polisher, came into use.³ These examples are cited to show what the trend of technical advance has been. Many plants build their own machines, and hence the types are varied. Some works are now using machines that concentrate the cleaning and polishing. In these combination machines ground peanut shucks are the absorbent cleaning material, while rolls of cotton flannel disks do the polishing.

Practically all of the plants in this country use machinery for cleaning and polishing. One works at Follansbee, West Virginia, makes special qualities of tin plate and still does some hand cleaning and polishing. In Wales many works still employ women and girls to do this work because their labor is cheap. Hand labor is employed on specialties.

American manufacturers generally equip their tin houses with traveling cranes to transport all materials to the sorting- and packing-rooms and to handle machinery. In the packing-rooms many have installed machinery for making boxes. These improvements are almost unknown in Wales.

¹ Parliamentary Documents. *Report on the Manufacture of Tin Plates*, 1912, Cd. 6394, p. 14.

² *Iron Age*, September 20, 1894, p. 479.

³ *Ibid.*, 1895, p. 637.

Conclusion

Technical progress in the rolling, annealing, and cold-rolling departments has certainly advanced further in the United States than in Wales. America has followed up improvements in pickling and tinning more fully than has her rival, and in general plant equipment this country has gone far ahead of Wales.¹ Some Welshmen claim that the Americans brag of things they have stolen from others, but how the manufacturers of the new country got their ideas of advance is really beside the point. They have taken up the manufacture of tin plate and improved all the processes to a remarkable extent and have more than kept abreast of improvements made in Wales. The industry is one that has given the American genius for mechanical invention and organization a fertile field to work in, and that American genius has raised a good crop of ideas. Technical progress has been a primary factor in the remarkable growth of the tin-plate industry in the United States.

¹ *Iron and Coal Trades Review*, May 2, 1901.

CHAPTER IV

LABOR

DISCUSSION of the nature of tin-plate manufacturing and of technical progress made during the past twenty-five years gives some inkling of the difficulties that beset an investigation into the part labor has played and now fills in the industry. It is necessary to study various grades of work-people from highly skilled hot-mill workmen to common laborers drawn from the lowest compartment of industrial society. The study is further complicated by the many changes that have occurred. However, the importance of understanding the influence the factor labor has wielded in this country in the phenomenal growth of a new industry, and in Wales in the reconstruction of an old industry, necessitates an expedition through a labyrinth of wage scales, strikes, figures, and comparisons.

Labor conditions in America

It is well to begin with a table showing the number of work-people employed at different periods:—

*Number of work-people engaged in tin-plate manufacture*¹

Year	1899	1904	1909	1914 (estimate)	Per cent of increase 1899-1914
Total . . .	14,826	17,164	18,956	21,000	50
Black-plate mills . .	11,155	12,319	13,604		
Tin dipping .	3,671	4,867	5,352		

This table is rather meager, for it begins with 1899, and for 1914 gives only an estimate. However, it is sufficiently

¹ *Thirteenth Census of the United States, 1910. Report on Manufactures, vol. x, p. 273-74.*

complete and accurate for the purpose. It shows that the increase in the number of work-people has not been proportional to the increase in production. Since 1899 the output has increased some two hundred per cent, but the number of work-people has augmented only about fifty per cent. The rate of increase is higher in the tin house than in the black-plate department.

Study of the composition of this body of work-people shows that women and children have played an insignificant part in the growth of the industry. In 1899 there were only 63 women and 308 children employed in the black-plate branch and 625 women and 32 children in dipping. Less than 7 per cent of the total number of work-people were women and children. Unfortunately there are not corresponding figures for 1909, but it is quite probable that this small percentage has declined. More complete statistics exist for the tinning department.

*Average number of wage-earners in the tin-plate andterne-plate dipping industry*¹

	1899	Per cent	1904	Per cent	1909	Per cent
Total . . .	3,671	100.0	4,847	100.0	5,352	100.0
16 years of age and over . .	3,639	99.1	4,791	98.8	5,322	99.4
Male . . .	3,014	82.1	4,212	86.9	4,827	90.2
Female . . .	625	17.0	597	11.9	495	9.2
Under 16 years of age . .	32	0.9	56	1.2	30	0.6

Note that the number of women has declined and that the percentage of females to the total number of work-people has fallen from 17.0 per cent to 9.2 per cent. The number of employees under sixteen years of age is trivial — 0.6 per cent of the total in 1909. The use of cleaning and polishing machinery has displaced many females. Those still employed generally work in the sorting- or packing-

¹ *Thirteenth Census of the United States, 1910. Report on Manufactures, vol. x, p. 274.*

room, and occasionally at the opening-bench. Women and children have never been so important in the trade in this country as they have in Wales. In 1906, thirty-four per cent of the total number of work-people in Wales were women and children.

Unfortunately the Census Bureau has not compiled statistics to demonstrate the racial composition of the body of tin-plate workers. Despite lack of figures, there are certain well-known facts. The decline in the number of Welsh hot-mill workers has been continuous, until many mills employ not a single Welshman.¹ American manufacturers never appreciated the efforts of "Davy Jones" and "Tommy Thomas" to show how they made tin plate in Wales. A great many unskilled foreigners, who earn the \$1.70 per day wage, work in the opening, pickling, and cold-rolling departments. They also do general work about the plants and feed the bar shears. Foreigners may work up into the other processes such as tinning that require some intelligence and care, and pay good wages.

Hot-mill labor

Welsh hot-mill workmen brought over to America the traditions of strongly organized labor, and the mill men in this country soon formed a branch of the Amalgamated Association of Iron and Steel Workers, which became known as the Amalgamated Association of Iron, Steel, and Tin Workers.² This organization was the strongest union in the steel industry, and possessed, in 1891, 24,068 members, enrolled in 290 lodges. Its policy was very exclusive, for it aimed to include only skilled workers, and its position was very strong, for conditions in the iron and steel industry were radically different then from what they are to-day. The consolidation movement had not begun, and

¹ *Iron Age*, September 22, 1892, p. 533. Excerpt from the London Engineer. *Ibid.*, January 26, 1893, p. 193.

² *Report on the Conditions of Employment in the Iron and Steel Industry in the United States*, op. cit., vol. III, p. 115 ff.

ownership of plants was usually vested in a partnership or a single individual. Furthermore, the effects of technical progress were just beginning to work out and to substitute common laborers for skilled workmen. The latter were scarce and could dictate terms, but the supply of common laborers is almost unlimited, on account of immigration, and generally plastic. In 1890 the unions were so strong that employers were considering steps to unite to oppose their demands, but other great factors eliminated the necessity. Trusts and technical progress have destroyed the power of the unions, until to-day labor is unorganized in practically every branch of the iron and steel industry. Slight vestiges of old-time power remain in the bar-iron, sheet and tin-plate mills, and it is with the history of the struggles and vicissitudes of the Amalgamated Association in the tin-plate industry that we now deal.

After the crushing defeat experienced by the Amalgamated in the Homestead strike of 1892, it was constantly on the defensive and seeking to check the decline of its power. The old aggressive policy was broken, but during the last decade of the nineteenth century, it still had great strength in the iron mills of the Western Bar Association, in the sheet, tin, and hoop mills throughout the country, and considerable strength in the steel works of Ohio and Illinois.

The great combination movement of the later nineties stirred the Amalgamated to aggressive action in 1900, and in the convention of that year it put forth a declaration of combined action, which said: "Should one mill in a combine or trust have a difficulty, all mills in said combine or trust shall cease work until such grievance is settled."¹

This statement of policy provoked little discussion at the time and was readily adopted, but if its import had been seriously considered, it is likely that the declaration would never have been made.

¹ Constitution of the Amalgamated Association of Iron, Steel and Tin Workers, Article 17, section 22.

In the following year the United States Steel Corporation combined the great trusts already formed in the iron and steel industry, and immediately faced the labor problem. The executive committee laid down three lines of action to determine the relations of the Corporation to its employees. First, it was asserted that each subsidiary company — for example, the American Tin-Plate Company — would deal directly with its work-people. This policy, however, was not adhered to, for the Steel Corporation has directed action from the beginning. Second, considering the critical situation in which the Steel Corporation was, it was deemed advisable to recognize and treat with the Amalgamated Association, but the principle of organized labor was vigorously opposed. This was merely a temporizing policy. Finally, the Steel Corporation maintained unconditionally that it would countenance no extension of organized labor to non-union mills. If it was forced to sign scales for mills previously non-union, it closed them down and diverted as much work as possible to non-union plants.

In the tin-plate industry the Amalgamated, which included the hot-mill labor, was strong and won recognition from the American Tin-Plate Company in every plant but one, the Monessen, which was operated under a different scale than the others. The Amalgamated prepared its scales annually and submitted them to a convention of delegates from the national lodges, usually held in May. This body considered all proposed changes and constructed the scale, which was later agreed on in a conference between labor delegates and representatives of employers. If accepted, it went into force July 1. In 1901 the American Tin-Plate Company had signed the scale for all but the Monessen plant, and probably agreed orally to sign for all, if the Amalgamated secured recognition in all the plants of the American Sheet-Steel Company. The latter had been signing for only about two thirds of its mills, and the

Amalgamated had determined to secure general recognition. Not only did the Sheet-Steel Company refuse to grant the demand, but it also put forward counter-proposals to the union. Failing to reach any agreement, the Amalgamated declared a strike on July 1, 1901. On July 11, 12, and 13, further conferences were held, but no results were obtained. So on July 15, by virtue of the declaration that if one mill in a trust should have a difficulty, all mills in the trust should cease work until this grievance was settled, the president of the Amalgamated Association summoned the tin-mill labor to strike. Later, workers in steel mills were ordered to join the movement. The Amalgamated did not receive much public sympathy in this struggle, especially because it was violating its agreements with the American Tin-Plate Company and other steel concerns. The strike dragged on until the middle of September and ended disastrously for the Amalgamated.

In the tin-plate industry the Association lost fourteen mills that were formerly union. It retained twenty mills, but twelve of these have since been abandoned. Most of them were marked for dismantlement when the strike was settled. Only eight of the union mills were first-class, and in ordinary times the non-union mills could take care of all orders. In the agreement that settled the strike it was set forth: (1) that there should be no more sympathetic strikes against the trust; (2) that the Amalgamated should not seek to extend its organization; (3) that its members should not interfere with non-union men in any way; and (4) that individual scales were to be allowed for improved mills. The strike was truly a disastrous blow to the Amalgamated Association.

From 1902 to 1907 its history was comparatively uneventful. There were internal dissensions arising out of attempts at reconstruction and broadening of policy, and these finally resulted in 1907 in the secession of the puddlers, who withdrew and reconstituted the Sons of Vulcan.

Throughout this period the Association was gradually losing ground.

Finally, in 1909, the American Sheet and Tin-Plate Company took the initiative and precipitated the struggle that terminated the existence of the Amalgamated Association in the plants controlled by the Steel Corporation. In June, 1908, the Company had signed the scale for ten of its works, but on June 1, 1909, it posted a notice that it would not sign any more scales. The notice read: —

“After a careful consideration of both the company and its employees, the American Sheet and Tin-Plate Company has decided that all its plants after June 30, 1909, will be operated as ‘open’ plants.”

The Company then set forth its own scale of wages, which were from two to four per cent below the Amalgamated scale. The sliding scale that had been a feature of the Association’s list was abolished. The Amalgamated scale had given the wages which should be paid when tin plate was selling at or below a certain minimum (\$3.90 per box of 100 pounds), and provided that when the price of tin plate advanced ten cents per box, wages should increase two per cent. As a matter of fact, tin plate had not sold above \$3.90 since October, 1902, so that the loss of the sliding scale was a matter of principle. Elimination of footnotes which had dictated working conditions also disturbed the Association.

The Amalgamated attempted to confer with the Company, but the latter refused even to negotiate. There was nothing left for the union to do but fight, and it declared a strike July 1, 1909. Mill men from nine works responded, but they were not in a position to hold out. The American Federation of Labor contributed its support, and enabled the men to stand to their guns. The Company, however, employed non-union men and diverted orders to non-union mills, so that it was quite able to get along without the Amalgamated Association. Union men made attempts to

organize the non-union mills, but they could not accomplish anything. Then, on May 1, 1910, the Company effected a shrewd stroke by advancing wages a few cents higher than the Amalgamated scale. From then on the strike lost strength rapidly, and was declared off August 27, 1910.

This disaster practically completes the history of the Amalgamated Association. Its power has gradually disintegrated until to-day it includes only 4355 members, of whom 1576 are employed in the sheet and tin-plate trade. In 1905 70 per cent of the workmen operating the hot mills were organized, and to-day only 13 per cent are still in the ranks of the Amalgamated Association.¹ The United States Steel Corporation maintains the "open shop" in all its plants, and most of the large independent firms do not sign the Amalgamated scale.

There are two fundamental causes for the disorganization of labor in the iron and steel industry — the introduction of automatic machinery and the determination of American manufacturers to run their own plants. In tin-plate manufacturing automatic machinery has been tried, but could not displace skilled tin-mill labor; nevertheless the manufacturers have won in their struggle to obtain full utilization of the improvements in methods and machinery, which union restrictions would have vitiated. The main struggle between employers and employees has been fought on the issues of the extension of unionism and the control of working conditions, and the employers have won a complete triumph. While they have been combining into vast corporations to check competition, they have shattered consolidation among workmen and deal now with individuals.

Thus far the story of the decline of the Amalgamated Association has not dealt with the course of wages paid to

¹ *Iron Age*, June 15, 1905, p. 1900.

Figures for 1914 furnished by Mr. B. E. V. Luty.

the mill labor, principally because disputes have not centered about wages. Now, however, we shall turn to an examination of several of the scales of the Amalgamated Association and trace the course of wages since the inception of the industry. In the following table excerpts from various scales are given and they are the tonnage payments for number 30 gauge tin plate. The chart also shows the total tonnage payments which are easier to follow than the individual wages:—

Hot-mill scale (Gauge no. 30)

Year	Roller	Rougher	Doubling	Heating	Catcher	Shearer	Screw boy	Total
1892-1893 ¹	5.30		2.70	2.48		1.76		12.24
1896-1897	5.30		2.70	2.48		1.76		12.24
1897-1898	5.30		2.70	2.48		.88-.45		11.36-10.93
1898-1899	4.90		2.53	2.33		.88-.45		10.64-10.00
1899-1900	5.64		2.91	2.68		1.01-.52	.49	12.73-12.24
1900	2.25		1.44	1.47	1.10	.40		
1900-1912	3.22		2.12	2.20	1.10	.40	.72	9.76
1914	2.15	1.07	2.12	2.31	1.10	.40	.72	9.87

Average wages per day

	1900 ²	1913 ³
Roller.....	\$8.25	\$9.00
Doubler.....	6.10	6.50
Heater.....	5.25	4.25
Catcher.....	3.50	4.60 (no helper)
Shearer.....		4.90

These tables show what excellent wages hot-mill labor receives. A roller spends two or three years learning his trade, and in the actual operation must exercise his brain and body. Any such combination of apprenticeship, skill, and muscular exertion commands a high remuneration, especially in a new environment where it is scarce. The other workmen are not so skilled and do not occupy such an important position as the roller, and hence their wages

¹ *Iron Age*, 1892, p. 408. Amalgamated Scales (Western Bar Association). Published by National Lodge, Pittsburg.

² *Iron Age*, September 13, 1900, p. 16.

³ *Ironmonger* (London), December 27, 1913, p. 50. Report on U.S. Industry, by Sidney Jones. Figures from Follansbee Plant, Follansbee, W. Va., compiled by J. D. Williams.

are lower. When considered in conjunction with output, the tonnage figures give the average earnings per day. Total earnings are in most cases higher to-day than they were fifteen years ago, for although tonnage rates have fallen, the output has increased threefold. The roller receives \$9 and \$10 per day, the rougher about \$4; the doubler between \$6 and \$7; the heater \$4 to \$5; and the catcher about the same amount. There are some rollers who are earning \$2000 to \$2500 annually, while the other hot-mill workmen are making from \$1000 to \$1500.

The fall in total tonnage wages has been described as accompanying the increase in the rate of output. It was this tendency that the Amalgamated Association sought to check, but it followed inevitably the improvements in methods and machinery.¹ Tonnage labor payment has fallen about twenty-five per cent, but increasing rate of output has more than compensated for the reductions from the point of view of the workmen. This decline has helped to reduce the labor cost of tin plate. When it is remembered that the first payments for skilled labor were settled under unusual circumstances of scarcity and experiment, the fall in piece wages as the industry has been adapted to its new environment seems natural. It is well to point out here that the total tonnage wages paid in America are about twice the sum paid in Wales. The 1874 list, which regulates wages in Wales, fixes the tonnage payment at \$4.56.²

The first reduction of wages for hot-mill labor occurred when the Wilson Act went into effect in 1894, and reduced the duty on tin plate from 2.5 cents to 1.2 cents per pound. Manufacturers wanted a reduction of twenty-five per cent³ from the scale, but the Amalgamated Association refused to accept it and declared a strike which lasted from Sep-

¹ Special Report of the Commissioner of Labor, 1904, chap. III, *Iron and Steel*, p. 256.

² Parliamentary Documents. *Report on Collective Agreements between Employers and Work-people in the United Kingdom*, 1910, Cd. 5366, p. 129.

³ *Iron Age*, November 8, 1894, p. 794; November 29, p. 958.

tember, 1894, until January, 1895.¹ Some plants continued to operate with non-union labor and the Amalgamated sought to prevent the Tinned-Plate Manufacturers' Association from turning out any product on wages other than those agreed upon in the scale of July 1, 1894. The dispute was finally settled by reductions of $12\frac{1}{2}$ to 15 per cent. In 1897 the scale of prices in force before the reduction of 1894 was restored, and maintained until July 1, 1898, when the lower scale was again adopted. Protectionists blame the Wilson Act for the drop in wages in 1894, but it is to be noticed that the higher duty (1.5 cents per pound) of the Dingley Act did not prevent them from declining just as much.

When the American Tin-Plate Company made its first agreement with the Amalgamated Association, it restored wages to the old level and established a sliding scale arrangement.² When a box of 100 pound coke tin plate was selling at \$4.25, wages were to be those set forth in the scale. On each increase of ten cents in the price per box, wages advanced ten cents; and for each decline of ten cents they fell two per cent. Thus the mill labor was to share in the fluctuations of the trade, and it certainly benefited by the arrangement when the combination placed the price of tin plate at \$4.85 per box. This monopoly price increased wages for skilled labor twelve per cent.

The high level of wages continued until June 30, 1903 (except that the base price of the sliding scale was lowered to \$4.20), when a series of reductions began that have continued in force until the present time. In the scale for 1902-03 wages were reduced, and the base price of the sliding scale arrangement lowered to \$3.90.³ This reduction was written into the scale for 1904-05. Since 1909 the

¹ *Iron Age*, November 8, 1894, p. 784; November 29, p. 958; January 24, 1895, p. 169.

² *Ibid.*, September 29, 1899, p. 3; July 20, p. 20; May 24, 1900, p. 35.

³ *Ibid.*, March 24, 1904, p. 31; May 26, 1904, p. 2; July 7, p. 30.

American Sheet and Tin-Plate Company has not signed the Amalgamated scale, but has paid practically the same piece wages that are established by the Amalgamated. Some independent plants still sign the union scale, which is really representative of rates ruling throughout the industry. Protectionists have claimed that a high duty on tin plate has been necessary to safeguard the American workman, but it is noteworthy that the duty of 1.5 cents per pound did not prevent hot-mill wages from declining some twenty-five per cent.

Just as the Amalgamated Association failed to extend its membership and to win all tin mills in the country, so it failed to maintain its restrictions on the rate of output.¹ American manufacturers have contended continually for the abolition of limits on production. In 1899 the American Tin-Plate Company succeeded in having the limit raised to 5750 pounds per turn in the Amalgamated scale, and again in 1902 to 6250 pounds. In 1905 restrictions on output were abolished.² To-day the output of single turns runs up to 13,000 and 14,000 pounds. It was impossible to maintain the restrictive policy in the face of technical progress.

Another phase of the relations between the Amalgamated Association and the American Tin-Plate Company deals with wage rebates. The Trust desired to capture the reëxport trade, which the Welsh still retained, and arranged with the hot-mill workmen a plan whereby they received lower wages for tin plate to be sold to the large exporters. Of course the company had to sell this product at the Welsh price. Under the plan hot-mill workmen paid three per cent of their wages into a fund from which were to be drawn the wage rebates. On all tin plate sold to exporters at a price to meet the Welsh, the trust received from the fund a

¹ Special Report of Commissioner of Labor, 1904, chap. III, *Iron and Steel*, p. 256.

² *Iron Age*, January 3, 1907, p. 64.

drawback of twenty-five per cent of the tonnage wage payments made on the product in question.¹ Thus the workmen consented to a twenty-five per cent reduction of wages in order to enable the Company to capture the last portion of the American market left to the Welsh. The plan came into operation in 1902, but in 1904 the Amalgamated Association began to chafe under the arrangement.² Then the payments into the fund were reduced to $1\frac{1}{2}$ per cent of total wages, and finally in February, 1907, the arrangement was abandoned.³ It was estimated that the Steel Corporation disposed of 15,000 to 20,000 tons of tin plate yearly while the arrangement was in force. Not until 1911 did the trust appropriate the reëxport trade, and then without any wage rebate scheme. As the industry expanded, it naturally took over this market.

Three phases characterize the history of the relations between skilled labor and employers in the tin-plate industry — disintegration of organized labor, withdrawal of the trade from restrictions and working conditions imposed by workmen, and the clipping of wages. The demolition of limits on output has enabled workmen to follow the great improvements in methods and machinery and has been a fundamental factor in the growth of the industry. Likewise, the fall of tonnage payments from the very high level of the early years of the industry has helped to reduce the price of the finished product.

Other labor in the black-plate department

No special skill is required of the workmen who perform the remaining operations to prepare black plate for tinning. Most of these laborers are of the common grade and generally foreigners. They open the laminated packs, work at the pickling machines, feed the bar shears, and do general work about the mills. Their remuneration is $17\frac{1}{2}$ to 20

¹ *Iron Age*, June 9, 1902, p. 33. ² *Ibid.*, July 7, 1904, p. 30.

³ *Ibid.*, July 21, 1904, p. 230; January 2, 1908, p. 71.

cents per hour and amounts to about \$1.70 per day. Practically no labor is employed in the annealing department. Mechanical cold-rolling has displaced much labor. The initial feeding of the sheets is done by young fellows who later go to the hot mills.

In the hot mills the labor cost per ton of product is about twice as high as in Wales, but in the opening, pickling, annealing, and cold-rolling departments it is less. Individual wages may be higher, but fewer work-people are employed to do a much larger amount of work. Machinery accounts for the difference.

Tin house

In the tin house, too, the labor cost is less in this country than in Wales. The Welsh tinman receives 3*d* (6 cents) per box, while the American receives 5½ cents. The tinman merely feeds the sheets to the machine and does not require special training and skill. As Mr. Reid, of the American Tin-Plate Company testified, the Company could take a boy from the farm and teach him the job in a short time.¹ In the early nineties wage payments were much higher in this country. Under the five-pot method tinmen and washmen received 12 cents per box; risers, 4 cents; cleaners, 3 cents; and dusters, 2.5 cents.² Thus the labor cost per box under the old hand methods was 33.5 cents. To-day, the tinman, who receives 5½ cents per box, is the only workman employed in the tinning, cleaning, and polishing operations.

In the early days skilled tin-house labor was organized in the Tin Workers' International Protective Association, but the introduction of machinery destroyed the union. When the American Tin-Plate Company had its first dealings with tin-house labor in 1899, it granted a general 25 per cent increase of wages. Tinmen were to receive from

¹ *Report of the Industrial Commission*, 1900, vol. 1, p. 879.

² *Iron Age*, 1892, p. 408.

4½ cents to 7½ cents per box, and risers from 3 to 4½ cents.¹ Since then the riser has been ousted. To-day the tinman receives a good wage, for on the large jumbo machines, which turn out 70 boxes per day, he can earn from \$3 to \$3.50.

General developments

The following table presents the labor cost of a box of tin plate at different stages of the industry's history: —

<i>Year</i>	<i>Labor cost</i>
1894 ²	\$1.60
1898	1.00
1900	1.15
1914 ³	0.55-.60

This large decline of over sixty per cent is due to the clipping of wages, technical progress, and general improvement in the conduct of the trade, and the enormous growth of output. Labor cost does not increase in proportion to output, and hence its relative importance has declined with the expansion of the industry.

Labor in Wales

About 1890 there were probably over 25,000 work-people engaged in tin-plate making in Wales.⁴ One authority in 1888 estimated the number at 29,000, but the smaller figure is the safer. To-day a liberal estimate of the number is 21,000.⁵ Thus there are about as many engaged in the industry in Wales as in America.

Changes have occurred in the composition of this group.

¹ *Iron Age*, June 15, 1899, p. 11.

² *Report of the Industrial Commission*, vol. I, 1900, p. 868 (footnote).

³ Information furnished by manufacturers.

⁴ R. B. Thomas, *Proceedings of the Institution of Mechanical Engineers*, 1906, p. 489.

Parliamentary Documents. *Report of Her Majesty's Chief Inspector of Factories*, 1888, pp. 45 to 59.

⁵ *Labour Gazette*. British Board of Trade.

A large increase in the relative proportion of adult males, and decreases in the relative proportions of women and children have occurred. Common observation shows these facts, but they are also demonstrated by statistics gathered in 1906 covering 10,596 work-people, or about 55 per cent of the group.¹ In 1886 adult males formed little more than one half of the total number employed; in 1906 two out of every three were adult males. Boys constituted over 24 per cent of the group in 1886, but not quite 20 per cent in 1906. The percentage of women dropped from 17.5 per cent in the former year to 11 per cent in the latter; that of girls from a little over 6 per cent to 3 per cent.²

The decline in the number of work-people and the change in the composition of the group are the results of technical progress. Wales produces about as much tin plate to-day as she did in 1890, but employs 4000 or 5000 fewer work-people. Hot-mill improvements and the introduction of tinning machinery eliminated many workmen. Mechanical cleaning and polishing have caused the decline in the relative importance of women.

The Welsh work-people have always been united in strong unions and have been able to have a voice in the conduct of the industry. Since 1874 wages have been regulated by the 1874 list, which was arranged by the workers and the Tin-Plate Makers' Association. During the depression of the nineties wages were based on this scale minus a certain percentage. To-day wages are uniform throughout the trade and are those of the 1874 List. On page 67 is a reproduction of the essential features of the wage scale.³

¹ Parliamentary Documents. *Report of an Enquiry by the Board of Trade into the Earnings and Hours of Labour of Work People of the United Kingdom*, vi, Metal, Engineering and Shipbuilding Trades in 1906. 1911, Cd. 5814, p. 56.

² *Ibid.*, p. xxix.

³ *Ibid.* *Report on Collective Agreements*, 1910, Cd. 5366, p. 129.

Tin-plate mills

(Per doz. boxes)

Rollers	3s. 5d.	{ A box of plates means on a basis of 14 in. by 10 in., 225 sheets, weighing 110 lbs. in Mills Area, 31,500 inches.
Doublers	2s. 9d.	
Furnacers	2s. 7d.	
Behinders	1s. 5d.	
Shearers	1s. 1d.	
Total	11s. 3d.	\$4.57 per ton (2240 lbs.)
Openers	6s. 3d.	per 100 boxes.
Pickling (black and white)	5s. 9d.	per 100 boxes for 4 mills.
	5s. 6d.	" " " " 5 to 8 "
	5s. 3d.	" " " " 9 to 12 "

Or employer's option, day work, at following minimum rates: —

7s. 6d.	Head pickler
6s. 6d. 2d	"
5s. 10d. 3d	"
Annealing (black and white) —	
coal 11s. 6d.	per 100 boxes. Gas 10s. 6d. per 100.
Cold-rolling —	
Roughers	2s. 2d. per day
Finishers	2s. 0d. " "
Assorters	1s. 9d. " "
Attenders	1s. 9d. " "
Greasers	1s. 6d. " "
Tinning —	3d. per box
Washing —	3d. " "
Risers —	
1st year	1d. per box
2d year	1½d. " "
3d year	1½d. " "
Assorting tin plates, 1d. per box.	

Only wages have been set forth in the above table; in addition the list prescribes all sorts of working conditions. Formerly a strict limit on production used to exist, but since 1900 the rate of output has increased. The idea has always permeated the principles of the Welshmen's unions that they must restrict output so as to prevent the clipping of piece wages. During the depression following 1891, output was strictly limited to thirty-six boxes per turn, and in some cases to thirty-two per turn. Since the

abandonment of restriction the average output per turn has increased to about forty-five boxes. Manufacturers claim that the men do not follow the machinery as they ought to, and that the old principle of restraining production still dominates their work. The American mills employ seven men and turn out from one hundred and twenty to one hundred and thirty boxes per turn, which is about three times greater than the Welsh output. It has been the attempt of the Welsh to restrict output and to define working conditions that prejudiced American manufacturers against them.

Average earnings in Wales¹

The following table presents average earnings for full time by various grades of work-people in 1886 and 1906:—

Occupation — average earnings for full time

Occupation	1886		1906		Per cent of increase
	Per week	Equivalent in dollars	Per week	Equivalent in dollars	
<i>Men</i>	<i>s.</i> <i>d.</i>		<i>s.</i> <i>d.</i>		
Furnacemen (piece) .	34 3	\$8.22	47 3	\$11.34	38.0
Rollers " . . .	47 0	11.28	62 10	15.08	33.7
Doublers " . . .	40 0	9.60	50 9	12.18	26.9
Shearers " . . .	44 4	10.64	61 3	14.70	38.2
Tinmen	42 4	10.16	43 6	10.44	2.8
General laborers' time	17 5	4.18	22 9	5.46	30.6
All men	33 5	8.02	42 0	10.08	25.7
<i>Women</i>					
Openers (piece)	11 8	2.80	16 9	4.02	43.6
All women	10 4	2.32	14 9	3.54	42.7
All work-people	22 5	5.28	32 1	7.70	43.1

This table gives a very good idea of the course of wages in the twenty years from 1886 to 1906. All grades of work-people are earning more now than they did twenty-five years ago because of the increase in the rate of output. Piece wages are practically the same. The large percentage

¹ Parliamentary Documents. *Report on Earnings and Hours of Labor*, vi, 1911, Cd. 5814, p. xxix.

of increase (43.1) of the weekly earnings for all work-people exaggerates the increase of earnings, for the decline in the relative importance of women and children must be accounted for. They earn less than the male workers, and if their number relative to the group falls off, average earnings rise. Nevertheless, there has been a large increase in earnings for all concerned, as the table demonstrates.

That individual wages are lower than those paid in America is very noticeable. Rollers make from \$15 to \$20 per week; in America they earn from \$40 to \$50. Doublers make \$12 to \$15 in Wales; in the United States, about \$30, etc. The disparity in tin-house wages is smaller, for the Welsh tinman earns about \$11 and the American \$15 to \$18.

During the depression of the nineties labor troubles were frequent. In 1894 wages were reduced from $7\frac{1}{2}$ to 25 per cent below the 1874 list.¹ Reductions were less drastic in 1895 and averaged about $12\frac{1}{2}$ per cent.² For those workmen who allowed an extension of the limit on output to 40 boxes per turn, the list was reduced 10 per cent. By the end of 1896 the general level of wages was 25 per cent below the standard, and the workmen decided to rebel.³

They held a council meeting and determined to regain the 1874 List. Accordingly, they gave notice to the employers of forty-five firms that unless wages were restored, work would cease in one month.⁴ With few exceptions employers refused and closed their works. Some 5000 work-people went on a strike. Finally the dispute was settled, when the workmen accepted a temporary reduction of 15 per cent from the list, with the understanding that the full list should be restored before December 1.

This arrangement was short-lived, for during 1897 and

¹ *Labour Gazette*. Published by the Board of Trade, London. December 18, 1894, p. 371.

² *Ibid.*, January, 1895, p. 19. ³ *Ibid.*, November, 1896, p. 335.

⁴ *Ibid.*, November, 1896, p. 335.

1898, and until July, 1899, reductions of wages were large and general. They ranged from 15 to 25 per cent.¹

With signs of returning prosperity in 1899 came an agreement between the Welsh Sheet and Plate Manufacturers' Association and various trade unions, which provided that after October 1, the full 1874 List should prevail.² This agreement affected about 15,000 work-people and marked the end of a long struggle between employers and employees.

This settlement is important also, because it established the South Wales Tin-Plate Conciliation Board which meets annually to consider wage questions.³ The body consists of representatives of employers and workmen. Whenever a dispute arises anent wages or conduct of the trade, a joint committee of three employers and three workmen investigates the matter thoroughly and decides it. If this committee cannot come to an agreement, it refers the dispute to an arbitrator, named by the Board of Trade. The conciliation scheme has worked admirably since its inception, and has settled a number of important questions. Despite the multiplicity of rates to be settled, and the large number of different grades of work-people, agreements have been universally accepted and peace maintained. The work-people have adhered to agreements honorably. The efficacy of this industrial mechanism is apparent when it is stated that it settled 2488 disputes in 1911, and 1287 in 1912.⁴

The wages agreement is renewed from year to year, and, with some exceptions, has remained practically as it was in 1899. The chief change has been from payment by weight in the hot mills to payment by area, which took place in

¹ *Labour Gazette*, 1897, pp. 57, 89, 345, 378; 1898, pp. 59, 90, 281, 377.

² *Ibid.*, July, 1899, p. 198.

³ *Times* (London), July 3, 1912, p. 7.

Parliamentary Documents. *Report on Collective Agreements*, 1910, Cd. 5366, pp. 127-29.

⁴ Information furnished by the Board of Trade, London.

1902 and 1904 and resulted in an average increase of wages of about two per cent.

In contrast with conditions in America the power of organized labor in Wales has not declined. Workmen still dictate conditions under which they shall work, and have suffered no reduction of piece wages. Restrictions on output, however, have been abolished and the rate of output increased. It is to be noted also that the 1874 List settles wage rates for all grades of workers, from the hot-mill laborer down to the common workman. Whole families work at the trade in Wales and always have, and when any changes have been made to the detriment of one group of workers, the other groups have opposed them. New machinery, such as tinning, and cleaning and polishing machines, met great resistance in Wales. The people are by nature conservative and oppose anything that savors of novelty. Even to-day, they oppose innovations and sometimes refuse to coöperate with them, until manufacturers have to return to old methods.¹

*Comparisons between conditions in Wales and the
United States*

1. At the present time the United States produces some 250,000 tons more of tin plate than does Wales, yet the number of work-people is about the same in both countries.

2. The hot-mill tonnage payments in America are about twice those in Wales. For number 30 gauge, the rate in this country is about \$9.50; in Wales, about \$4.50. In the other departments such direct comparisons are impossible, but while individual wages are higher in America, the labor cost per unit of product is less than in Wales.

It is also difficult to make comparisons between the standards of living enjoyed in the two countries. In Wales whole families work at the trade and may probably earn

¹ At Briton Ferry a manufacturer installed gas furnaces, but had to remove them owing to the opposition of the workmen.

£5 and £6 (\$25 to \$30) per week. This is an excellent family wage in a country where prices are so low. Even the individual wages are good. The average weekly wage for all men in 1906 was over 42s. (\$10), probably equivalent to \$20 in the United States. Work-people own their own homes and enjoy a wholesome standard of living.

In the United States the skilled labor of the hot mill, earning from \$1000 to \$2500 annually, can enjoy some of the good things of life. They can maintain excellent homes and live even on a higher plane than the skilled workers of Wales. Little can be said of the manner of living of the common \$1.70 per day laborers of the steel district. They live in the way that they did in southern Europe and probably save a portion of their earnings.

3. American manufacturers have said a great deal about the disparity in labor costs between this country and Wales. Taking a standard box they have figured out various differences, ranging from 34 cents up. At the present time the Welsh labor cost of a standard box of tin plate is from 2s. 3d. (54 cents) to 2s. 6d. (60 cents). Some works may manufacture for 2s. 2d. (52 cents), but that is a low cost. Inquiries in America bring out the remarkable fact that the labor cost here is just about equivalent. One representative firm states that the cost varies from 55 to 60 cents, and hopes to reduce it a few cents lower by the introduction of patent doublers.

Thus, although American firms pay double the tonnage wages the Welsh do and higher individual wages in the other departments, the actual labor cost per unit of product is practically the same in this country as in Wales.

The fact that 21,000 work-people in this country produce 250,000 tons more of tin plate than 21,000 do in Wales shows that the United States turns out tin plate with a less expenditure of human energy than do the Welsh. With the larger output the American manufacturers can afford to pay higher individual wages than the Welsh and yet have

no higher money labor cost per unit of product. Of course, before the enormous expansion of output during the last few years, the money cost of labor per unit of product was higher in this country than in Wales. It was this disparity that led the American Tin-Plate Company to arrange a twenty-five per cent wage rebate with its hot-mill labor in order to capture the reëxport trade from the Welsh. It was the reduction of the difference that has enabled the American manufacturers to capture the reëxport trade and the Canadian market too.

CHAPTER V

ASSOCIATIONS AND COMBINATIONS, PROBLEMS IN INDUSTRIAL ORGANIZATION

I. UNITED STATES

FROM a study of the internal growth of the tin-plate industry we turn to the phases of industrial organization through which the trade has passed. The aim of this chapter is to deal chiefly with the problems of monopoly, and so it may well begin with an examination of prices, for in this industry, as in hundreds of others, declining prices have been held responsible for the concentration of control. The accompanying chart needs some explanation in order to be clear.

In the first place, it must be stated that any such compilation of figures can at best only suggest the truth. An outsider cannot take figures for prices and determine accurately just what costs were over a certain period and what profits. If there is anything to be learned from a study of this sort, it is, that to reach perfectly definite conclusions, access must be had to the true sources of information. Such opportunities an expert government body alone might obtain. Books on economic subjects, and particularly the so-called trusts, have price charts galore, but the more one studies them, the more one finds they are of little value, except to point out very broad conclusions. The prices given in this case are taken from the *Iron Age* and are reliable. The figures for labor cost are compiled from different sources and are fairly accurate. Certainly those for 1902-06 are, for they were gathered by the Bureau of Labor; the cost given for 1913 is also pretty accurate.

Until 1899 the quotations for tin plate were based on the old Welsh standard of 108 pounds. As raw materials for this standard box, there are figured 110 pounds of steel and 2.5 pounds of tin.

In making tin-plate price charts most authorities build up from steel billets. Of course, sheet bars are the real raw material, but they are rolled from billets which serve very well in their stead. Since 1899 the American quotations on tin plate have been on the 100 pound basis, and raw materials allowed to the base box are 110 pounds of steel (good measure) and 2 pounds of tin (also liberal). Labor costs from 1906 to 1912 would be guesses, and are therefore left out.

*Price chart*¹

<i>Year</i>	<i>Steel billets (per 100 lbs)</i>	<i>Pig tin (per lb.)</i>	<i>Tin Plate domestic coke Bessemer 14×20 (per 100 lbs. — 108 lbs. until '99)</i>
1890	\$1.52	\$0.2121	\$4.79
1891	1.26	.2025	5.33
1892	1.18	.2037	5.30
1893	1.02	.2002	5.37
1894	.82	.1912	4.89
1895	.92	.1405	3.87
1896	.94	.1330	3.63
1897	.75	.1358	3.26
1898	.76	.1551	2.99
1899	1.55	.2721	4.32
1900	1.25	.3066	4.66
1901	1.20	.2618	4.19
1902	1.53	.2648	4.12
1903	1.39	.2186	3.84
1904	1.10	.2799	3.64
1905	1.20	.3127	3.69
1906	1.37	.3722	3.89
1907	1.46	.3875	4.09
1908	1.31	.2942	3.89
1909	1.23	.2958	3.72
1910	1.26	.3420	3.84
1911	1.07	.4274	3.61
1912	1.00	.4639	3.45
1913	1.22	.4433	3.54

¹ Taken from *Iron Age*. Prices based on monthly averages.

Year	Margin between cost of raw material and selling price		Cost of labor per box	Margin between cost of labor and raw material and selling price
	Cost	Margin		
1890	\$2.18	\$2.61	\$1.60	\$1.01
1891	1.89	3.44	1.60	1.84
1892	1.80	3.50	1.60	1.90
1893	1.62	3.75	1.60	2.15
1894	1.35	3.54	1.33	2.21
1895	1.36	2.51	1.33	1.18
1896	1.33	2.30	1.00	1.30
1897	1.17	2.09	1.00	1.09
1898	1.23	1.76	1.00	.76
1899	2.24	2.08	1.15	.93
1900	1.97	2.69	1.15	1.54
1901	1.84	2.35	1.15	1.20
1902	2.20	1.92	.82	1.10
1903	2.08	1.76	.82	.94
1904	1.75	1.89	.82	1.07
1905	1.94	1.75	.82	.93
1906	2.29	1.60		
1907	2.36	1.73		
1908	2.02	1.87		
1909	1.94	1.78		
1910	2.06	1.78		
1911	2.01	1.60		
1912	2.02	1.43		
1913	2.22	1.32	.60	.72

During the period of inception, when the duty was 2.2 cents per pound and the prices of raw materials were falling rapidly, profits must have been extremely large.¹ The margin between the cost of raw materials and labor, and the selling price hovered about \$2 per box, much higher than it has ever been since. The facts that capital was attracted into the industry so readily and that the industry expanded so rapidly bear out this conclusion. Evidence by manufacturers who entered the field during this period is conflicting. According to one the rate of profits was 100 per cent, while another prominent manufacturer asserts that his firm made tin plate at the cost of \$9 per box and sold it for \$5.85.² Two statements could not be more

¹ *Iron Age*, May 17, 1894, p. 942.

² *Report of the Industrial Commission*, 1900. Trust Testimony, vol. 1, pp. 849, 887, 890.

diametrically opposed. From the figures one would say that the early *entrepreneurs* made large profits.

After the Wilson Act went into effect in August, 1894, the price of tin plate dropped about \$1 and so did the margin, but the domestic manufacture grew more rapidly than ever.¹ This fact helps to show that the previous high margin must have been on the right side of the ledger. The four years following the cut in the duty constitute a period of keen competition. Production increased rapidly, and prices decreased about as rapidly. The effects of competition are seen in the margin, which declined from \$1.18 to \$0.76 in 1898. Large profits under the tariff undoubtedly stimulated the growth of the industry. In November, 1898, the price of tin plate fell below \$3 and went to \$2.65. The domestic producers had by this time taken over the entire home market, the Welsh having been reduced to the export trade, and so the consumers of the United States were getting tin plate from a home industry at less cost than ever before.² During the period of inception the price of the American product remained steadily about \$2 per box above the price in Wales, but from 1894 to 1898 the difference was gradually reduced by domestic competition until the price of the American product was on a level with that of the Welsh.³

Although not a single firm had failed during this period of competition, the falling rate of profits was not regarded with satisfaction by the manufacturers, who made several unsuccessful attempts to stop the decline. In April, 1896, thirty-five manufacturers convened at Pittsburg and agreed to fix prices just below the importing point.⁴ Like most "gentlemen's agreements" this proved ineffective and did not prevent prices from continuing their down-

¹ *Iron Age*, January 17, 1895, p. 111.

² *Ibid.*, August 19, 1897, p. 15. Editorial on the wonderful growth during this period.

³ Of course the Wilson Act took off \$1 of the price.

⁴ *Iron Age*, April 23, 1896, p. 980.

ward course. Again in November, 1896, the Tinned-Plate Manufacturers' Association met and renewed the previous agreement.¹ The price of a box of I C 14×20 inch tin plate was to be \$3.65, and \$3.55 when sold in carload lots. The Association now included all but one manufacturer and was able to put up the price temporarily. In November the price became \$3.64, but it soon fell away; the temptation to do a larger business at lower prices was too great.²

Throughout the two years following, occasional meetings were held by manufacturers to bring about a consolidation of interests in the trade. In March, 1897, the Tinned-Plate Manufacturers' Association was renewed, with Mr. D. G. Reid as president.³ The following year, Mr. Reid called a meeting in February and sought to effect a combination between the producing and distributing elements in the industry.⁴ The four principal jobbers, the "Big Four," were at this meeting, and refused to support a promotion scheme in which they furnished one third of the necessary funds.⁵ At this time a combination was not regarded as imminent.

After the failure of the "gentlemen's agreements" the leading spirits in the combination movement sought the aid of the noted promoter, Judge W. H. Moore. He had already gained wide reputation for his consolidating ability by bringing about several large combinations, and he accepted this job on the understanding that he should have an absolutely free hand in dealing with the forty or more firms in the field. His plan was to strike a bargain for cash with each plant, or to offer stock, common and preferred, of a new corporation in payment. Each individual owner was dealt with separately and given the option of selling his plant for cash, or of accepting stock in the new concern

¹ *Iron Age*, November 26, 1896, p. 1005; January 7, 1897, p. 18.

² *Ibid.*, January 28, 1897, p. 18.

³ *Ibid.*, March 4, 1897, p. 12; April 15, 1897, p. 22.

⁴ *Ibid.*, February 10, 1898, p. 22.

⁵ F. L. McVey, in Ripley, *op. cit.*, p. 292 ff.

at the ratio of \$100 in preferred and \$100 in common stock for every \$100 in cash. At first many wanted cash, but when they saw the plan promised well, they accepted stock. Consequently, all the plants (thirty-nine) were purchased by stock in the new corporation.¹

This new organization, called the American Tin-Plate Company, was incorporated in the State of New Jersey with an authorized capitalization of \$50,000,000. Of this amount \$46,000,000 was issued, \$18,000,000 in preferred stock and \$28,000,000 in common stock. Apparently the \$18,000,000 of preferred and an equal amount of common stock were used by Mr. Moore to purchase 39 plants with 289 mills, but the promoter carried on these transactions himself and struck individual bargains. He may have paid out more or less, but those connected with the deal claim that all but \$10,000,000 of common stock was used for the purchase of plants and the provision of working capital, the remaining \$10,000,000 going to Mr. Moore and his associates as promotion profits.²

What the actual profit of Mr. Moore and his associates was, it is very difficult to say. It depended on the price realized for the \$10,000,000 of common stock, which fluctuated from \$20 to \$80 per share during 1899, 1900, and the first four months of 1901. Any attempt to state a definite figure would be a guess and of little value. Three or four millions may be near the mark. Of course the difficulty is accentuated by our ignorance of what Mr. Moore really paid out in stock to effect the combination, but since it is generally understood that he used all the preferred stock and \$18,000,000 of the common for the purpose, we

¹ *Report of the Industrial Commission*. Trusts, vol. I, 1900, p. 849.

United States vs. United States Steel Corporation. In the District Court of the United States. Transcript of the Record, vol. I, p. 428.

United States Steel Corporation Investigation Committee Report, 62d Congress, 2d Session, House Doc. 1127, p. 23.

² *United States vs. United States Steel Corporation*, *op. cit.*, vol. I, p. 415 ff.

may regard that statement as the truth. However indefinite we may be as regards actual figures, we may be sure that Mr. Moore and his associates reaped an extremely large reward for their work.

It is worth while to examine the charter of the American Tin-Plate Company, for it possesses certain unique features.¹ Following are the principal features of the document: —

1. Capital stock, \$50,000,000; \$20,000,000 preferred and \$30,000,000 common stock. The preferred shares bear 7 per cent cumulative dividends.

2. In the event of liquidation or dissolution of the corporation the holders of the aforesaid cumulative preference shares shall be paid the full amount with accrued dividends. After such payments the remaining assets shall be divided among the holders of the other shares.

Capital

3. The amount of capital stock with which it will commence business is \$10,000.

Object

4. (a) To manufacture and trade in tin, terne, block plates, steel plates, and all like or kindred products, to mine, manufacture, prepare for market, market and sell the same, and any articles or product in the manufacture or composition of which metal is a factor; including the acquisition by purchase, mining, manufacture or otherwise of all materials, supplies, and other articles necessary or convenient for use in connection with and in carrying on the business herein mentioned, or any part thereof.

(b) In addition to the general powers the Company shall also have the following powers: To manufacture, deal, own, sell, transfer, etc., goods, wares, and property of every description and to do mining of any kind. To also own and dispose of real estate in any part of the world to any amount. To acquire good-will and rights and property of any kind and to undertake the whole or any part of the assets and liabilities of any person, firm, association, or corporation, and to pay for the same in cash, stocks of this corporation, bonds, or otherwise. To also apply for, hold, own, dispose of patents, processes, licenses, and trade marks, etc.

¹ *Iron Age*, December 15, 1898, p. 22; F. L. McVey, in Ripley, *op. cit.*, pp. 311-13.

To make contracts with any individual firm, association, corporation, and with the Government of the United States or any State or colony. To do all and everything necessary to promote the interests of stockholders whether manufacturing, mining, or otherwise.

Directors

5. Directors shall be divided into five classes; the first class being elected for five years, the second four, etc., so that the term of office shall be five years thereafter. The board shall fill vacancies in the board. It shall have the power to make and alter by-laws.

With the assent in writing and pursuant to the vote of two thirds of all stock irrespective of class, directors shall have the power to sell, assign and transfer, convey or otherwise dispose of the property and assets of this corporation as the directors may see fit.

An executive committee consisting of five members shall have the power to conduct the business when the directors are not in session. Officers of the committee shall be a chairman, vice-president, and a secretary. They shall be elected by all the stockholders. The term of office shall be coextensive with the office of director. Members of the committee shall not be subject to removal for any cause by the board of directors, and shall hold office until their successors are elected. No stockholders shall have the right to inspect any account, book, or document of the corporation except as conferred by statutes of New Jersey or authorized by the directors.

Several features distinguish the charter. First, the rights of stockholders are fully protected. Section two gives the preferred stockholders preference as to assets. Moreover, there is no bonded debt and none can be created. Second, although the provisions of trusteeship are absent, the executive committee is in almost every sense the equivalent of the trustees in a trust. Its members are elected by the stockholders and cannot be removed by the directors, and its business is to control the affairs of the company. The stockholders have no right "to examine or inspect the accounts, books, or documents of the corporation, except as conferred by the statutes of New Jersey, or authorized by the directors." This, of course, means just as absolute

a control of the affairs of the Company as though the organization were a trust in letter as well as in fact.

Like most combinations the American Tin-Plate Company was enormously over-capitalized. In March, 1898, the capital invested in the trade was estimated at from three to five million dollars.¹ Mr. Reid, who became president of the Corporation, admitted that the real capital value of the industry did not exceed \$12,000,000 and that the preferred stock represented this cash value and every vestige of good-will. The \$28,000,000 of common stock represented the capitalized prospects of the new concern and possessed no tangible support. Thus the Combination was capitalized for at least four times its actual worth.

About ninety-five per cent of the American production was represented by this combination; it was a complete monopoly. In spite of this commanding power, the Company sought by various expedients to make its position unassailable.²

In order to prevent the rise of competing firms, contracts were made with practically all the manufacturers of tin-plate machinery in the country, providing that the American Tin-Plate Company should purchase the entire product of these firms.³ A combination always attracts a number of promoters who expect to build plants and to sell them to the trust at a fancy figure. The promoters of the American Tin-Plate Company were seeking to forestall any such attempts at blackmail. This alliance between the Trust and makers of machinery did not prevent the growth of competition, for many foundries turned to the manufacture of tin-plate machinery and independent plants were built. Originally the agreement was to last five years, but it was amended in 1902.⁴ Thereafter the Trust was to pur-

¹ F. L. McVey, in Ripley, *op. cit.*, p. 301.

² *Iron Age*, December 22, 1898, p. 17.

³ *Tin and Terne*, February 9, 1899.

⁴ *Iron Age*, March 13, 1902, p. 27; *Report of the Industrial Commission*, vol. I, p. 863 ff.; p. 887 ff.; vol. XIII, p. 558 ff.

chase its machinery from the manufacturers concerned at a reduced schedule of prices, and the latter were free to sell machinery to whomsoever they pleased.

In order to secure for the Tin-Plate Company an adequate supply of raw material and to render it independent of all other producers of steel, the promoters and officers formed in February, 1899, the National Steel Company, which had a yearly capacity of 1,800,000 tons of steel. The directorates of the two concerns interlocked, and the two companies were managed as one integrated concern.

Although the Combination embraced ninety-five per cent of the industry, it did not acquire possession of many brands of tin plate that were the property of dippers, jobbers, and retailers. Theretofore the latter had relied upon competing manufacturers to supply them with tin plate stamped with their own trademark or brand. Now the Trust refused to sell tin plate to them unless they assigned their brands to the Company and agreed, among other things, to make all their purchases of it. As the American Tin-Plate Company was then in an all-powerful position, it could compel the surrender of these private brands and force their owners into restrictive contracts. The principal features of these agreements were: (1) the private owner assigned to the Company the title to the trademark or brand; (2) in return the Company was to manufacture that brand for him exclusively; provided (3) he confined all his purchases of tin and terne plate to the Company. The Trust embarked on this policy three months after it was formed and succeeded in capturing many brands, thus preventing their manufacture by any independent producers that might establish themselves.¹

A decline in the number of firms engaged solely in the dipping of black plate had set in before the organization of the American Tin-Plate Company, and the Combination

¹ *United States vs. United States Steel Corporation*, vol. II, p. 549; *Report of the Industrial Commission*, 1900, vol. I, p. 891 ff.

hastened this development by cutting off the supply of black plate to such plants. Those dippers who were able to continue were protected by arrangements with some rolling mill or by assignment of their special brands.¹ Some officials claimed that black plate was sold to any one who wanted it, but said that it was desirable to eliminate the dippers. Undoubtedly there has been a natural tendency in the tin-plate industry, as was noted in the chapter on its growth in America, to consolidate the two branches — black-plate making and tin-dipping. Although the Combination's policy may have injured some firms, it merely hastened the inevitable outcome. The motives of the Company were to secure greater control of the tin-plate market, but they promoted a movement toward higher efficiency.

The Trust inaugurated a new policy for the distribution of its product. Since it was practically the sole producer, it ceased all dealings with brokers and established two sales districts: the eastern section with headquarters at New York, and the western division with headquarters at Chicago.² Quotations were made on carload lots, and only on request; smaller orders were turned over to jobbers nearest the customer. The Combination probably did effect a more economical distribution of product than had previously obtained. Later, when competition began to increase, rebates ranging from ten to fifteen per cent were granted to consumers who confined their purchases to the products of the Company.³

Promoters of the American Tin-Plate Company claim that large economies resulted from the consolidation. Mr. Reid testified that there was a reduction in office forces and a better distribution of product obtained. Thereafter,

¹ *Iron Age*, July 13, 1899, p. 6.

United States vs. United States Steel Corporation, vol. II, p. 894; *Report of the Industrial Commission*, Trusts, 1900, vol. I, p. 849.

² F. L. McVey, in Ripley, *op. cit.*, p. 316; *Report of the Industrial Commission*, 1900, vol. I, p. 874; *Tin and Terne*, January 26, 1899.

³ *United States vs. United States Steel Corporation*, vol. I, p. 521 ff.

orders could be filled from the nearest plants and shipments made only in carload lots. All inefficient plants were closed and the manufacture of tin plate concentrated in the largest and best-equipped works.¹

Now that we understand the dominant power of the American Tin-Plate Company at the beginning of its career, the policies it adopted to fortify its position, and the economies its organization was supposed to secure, we may turn to an examination of its price policy, or its dealings with the American public during its period of monopoly and until it was absorbed into the United States Steel Corporation.

Immediately after the formation of the Company in December, 1898, the price of tin plate rose rapidly. In December, the price was less than \$3 and about on a level with the price in Wales; in January, 1899, it was \$3.10; in February, \$3.50; in March, \$4; and from July until July, 1900, the price was \$4.85. Thus in the space of six months the price of tin plate increased nearly \$2 per box.

Officials of the Company allege that this great increase was due to the rising cost of raw materials and labor, and was in no sense arbitrary. It is quite true that the price of steel was increasing very much; also that of pig tin. To prove that the advance in the price of tin plate was entirely justified by larger expenses of production Mr. Reid presented to the Industrial Commission a complete set of figures, showing the prices for steel, pig tin, and tin plate. Upon analysis these figures hardly prove Mr. Reid's contention. (See pages 86-88.)

In 1898 the average price per ton of steel billets was \$14.66; in 1899, \$20.73. Tin, in 1898, averaged \$15.60 cents per pound; in 1899, \$26.80 cents. Labor cost \$1 per box in 1898; \$1.15 in 1889. The average price of tin plate was \$3.22 in 1898; \$4.48 in 1899. Allowing 110 pounds of steel

¹ *Tin and Terne*, February 23, 1899; *Report of the Industrial Commission*, 1900, vol. 1, p. 877.

Comparison of prices of Welsh and American tin plate, based on 108 pounds common coke Bessemer Welsh f.o.b., Liverpool

	1899	1900	1901	1902	1903	1904	1905	1906	1907	1908	1909	1910	1911	1912	1913
Jan.	\$2.67	\$3.69	\$3.46	\$3.34	\$3.04	\$2.85	\$3.04	\$3.16	\$3.65	\$3.10	\$3.04	\$3.04	\$3.46	\$3.92	
Feb.	2.79	3.69	3.28	3.34	3.04	2.92	3.10	3.16	3.65	2.98	2.92	3.04	3.58	3.24	
Mar.	2.79	3.80	3.28	3.46	3.04	2.79	2.92	3.16	3.65	2.85	2.85	3.22	3.71	3.30	
Apr.	2.79	3.80	3.28	3.46	3.04	2.79	2.92	3.16	3.65	2.98	2.85	3.22	3.71	3.35	
May	2.79	3.80	3.16	3.52	3.04	2.92	2.92	3.16	3.65	3.16	2.85	3.22	3.52	3.40	
June	3.10	3.80	3.28	3.52	3.04	2.98	2.92	3.16	3.70	3.16	2.92	3.22	3.40	3.54	
July	3.40	3.80	3.58	3.52	2.92	2.98	2.92	3.28	3.70	2.98	2.92	3.22	3.40	3.54	
Aug.	3.80	3.80	3.58	3.52	2.92	2.85	2.92	3.28	3.65	2.98	2.92	3.22	3.65	3.54	
Sept.	3.80	3.80	3.77	3.52	2.92	2.85	2.92	3.22	3.58	3.04	2.92	3.22	3.65	3.54	
Oct.	3.80	3.71	3.69	3.52	2.92	2.92	2.92	3.22	3.58	3.04	3.04	3.47	3.65	3.72	
Nov.	3.80	3.71	3.58	3.16	2.85	2.92	2.92	3.34	3.52	2.98	2.98	3.46	3.40	3.80	
Dec.	3.69	3.53	3.46	3.04	2.85	3.04	3.16	3.46	3.28	3.04	2.98	3.46	3.22	3.78	

April, 1914 — \$3.12.

American 108 pounds Pittsburg

	1899	1900	1901	1902	1903	1904	1905	1906	1907	1908	1909	1910	1911	1912	1913	1914
Jan.	\$3.25	\$5.20	\$4.51	\$4.51	\$4.08	\$4.05	\$4.03	\$3.94	\$4.41	\$4.26	\$4.19	\$4.24	\$3.88	\$3.67	\$3.88	\$3.67
Feb.	3.78	5.20	4.51	4.51	4.08	4.05	4.03	3.97	4.41	4.19	4.10	4.24	3.99	3.61	3.88	3.67
Mar.	4.25	5.20	4.51	4.51	4.21	4.05	4.03	3.97	4.41	4.19	4.03	4.24	3.99	3.56	3.88	3.67
Apr.	4.43	5.20	4.51	4.51	4.30	4.05	4.03	4.05	4.41	4.19	3.92	4.24	3.99	3.56	3.88	3.67
May	4.37	5.20	4.51	4.51	4.30	4.05	4.03	4.15	4.41	4.19	3.92	4.24	3.99	3.59	3.88	3.56
June	4.72	5.20	4.51	4.51	4.30	4.05	4.03	4.21	4.41	4.19	3.92	4.24	3.99	3.67	3.88	3.56
July	4.96	5.20	4.51	4.51	4.30	3.88	4.03	4.21	4.41	4.19	3.92	4.24	3.99	3.70	3.88	3.56
Aug.	5.20	5.20	4.51	4.51	4.30	3.77	4.03	4.21	4.41	4.19	3.92	4.24	3.90	3.78	3.89	3.78
Sept.	5.20	5.04	4.51	4.51	4.30	3.77	4.03	4.21	4.41	4.19	3.94	4.24	3.88	3.86	3.78	3.75
Oct.	5.20	4.51	4.51	4.51	4.30	3.77	3.83	4.21	4.41	4.19	4.03	4.24	3.75	3.88	3.88	3.50
Nov.	5.20	4.51	4.51	4.08	4.14	3.84	3.81	4.41	4.41	4.19	4.03	4.24	3.67	3.88	3.67	3.50
Dec.	5.20	4.51	4.51	4.08	4.08	3.84	3.87	4.41	4.41	4.19	4.12	4.24	3.67	3.88	3.67	3.45

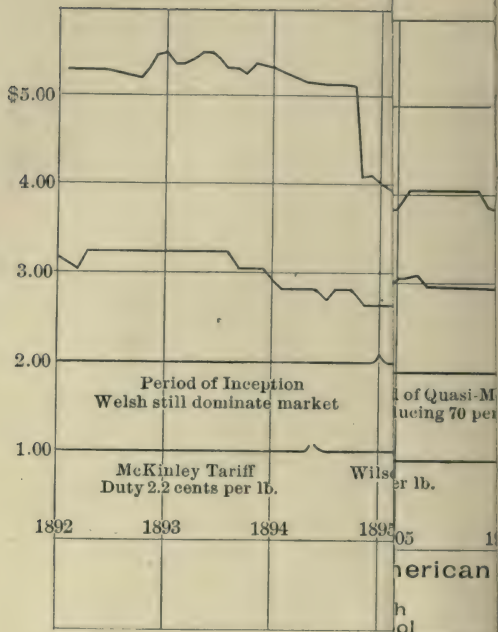
April, 1914 — \$3.25 100 lbs.
\$3.50 108 lbs.

THE TIN-PLATE INDUSTRY

Differences between Welsh and American Prices

	1899	1900	1901	1902	1903	1904	1905	1906	1907	1908	1909	1910	1911	1912	1913
Jan.	\$0.53	\$1.51	\$1.05	\$1.17	\$1.04	\$1.20	\$0.99	\$0.78	\$0.76	\$1.16	\$1.15	\$1.20	\$0.42	\$0.45	\$0.22
Feb.	0.99	1.51	1.23	1.17	1.04	1.13	0.93	0.83	0.76	1.21	1.21	1.20	0.41	0.37	0.27
Mar.	1.56	1.40	1.23	1.05	1.17	1.26	1.11	0.83	0.76	1.34	1.18	1.02	0.28	0.26	0.54
Apr.	1.64	1.40	1.23	1.05	1.24	1.26	1.11	0.89	0.76	1.21	1.07	1.02	0.28	0.21	0.56
May	1.58	1.40	1.35	0.99	1.24	1.13	1.11	0.99	0.76	1.03	1.07	1.02	0.47	0.19	0.52
June	1.62	1.40	1.22	0.99	1.24	1.07	1.11	1.05	0.71	1.03	1.00	1.02	0.59	0.13	0.50
July	1.56	1.40	0.93	0.99	1.38	0.90	1.11	0.93	0.71	1.21	1.00	1.02	0.59	0.16	0.51
Aug.	1.40	1.40	0.93	0.99	1.38	0.92	1.11	0.93	0.76	1.21	1.00	1.02	0.25	0.24	0.55
Sept.	1.40	1.24	0.74	0.99	1.38	0.92	1.11	0.99	0.83	1.15	1.02	1.02	0.23	0.32	0.51
Oct.	1.40	.80	0.82	0.99	1.38	0.85	0.91	0.99	0.83	1.15	0.99	0.78	0.10	0.16	0.57
Nov.	1.40	.80	0.93	0.92	1.29	0.92	0.89	1.07	0.89	1.21	1.05	0.78	0.27	0.08	0.51
Dec.	1.51	.93	1.05	1.04	1.23	0.80	0.71	0.95	1.13	1.15	1.14	0.78	0.45	0.10	0.51
Av.	1.38	1.26	.99	.94	1.24	1.03	1.01	.92	.81	1.17	1.07	.99	.36	.22	.48

Difference April, 1914 — \$0.38.



and 2.5 pounds of tin for a standard box of tin plate, including waste, we obtain the following costs and margins in the two years:—

	1898	1899
Steel in 110 lbs.	\$0.77	\$1.14
Tin 2.5 lbs.39	.67
Labor.....	1.00	1.15
	<u>\$2.16</u>	<u>\$2.96</u>
Tin Plate.....	3.22	4.48
Cost	2.16	2.96
Margin	\$1.06	\$1.52
Difference per box \$0.46.		

In 1899 the production of the Combination may be estimated as at least 6,000,000 boxes. Since the margin per box was increased 46 cents, the American Tin-Plate Company raised the receipts of the industry by some \$2,700,000 over those of the previous year. As we have made allowance for all increased expenses of production, we may say that the great enlargement of earnings represented monopoly profits. This conclusion we arrive at from Mr. Reid's own figures presented to justify the claim that the Combination did not advance prices arbitrarily.

Mr. Reid should have selected his data from the *Iron Age*, for our chart, constructed from the prices of that publication, does not work so unfavorably for his allegations. The margin for 1899 is \$0.93, or 17 cents higher than that for the previous year. This discrepancy demonstrates how different sets of figures will affect conclusions. Both show that the Trust did advance the price more than in proportion to the higher expenses of 1899, but our chart does not present such an arbitrary increase as Mr. Reid's.

If the contentions of Mr. Reid were true and the price of tin plate only followed increasing costs, it remains to be explained why the finished product continued to sell at \$4.84 per box until September, 1900, when the price of steel had fallen over \$6 per ton. The true policy of the

Company becomes perceptible immediately, for the margin as shown by the chart jumped to \$1.54, the highest level ever attained since 1894. The increase over the margin of the previous year was 61 cents per box, and if there is any doubt as to how much the Trust made in 1899 there can be no question that it made enormous gains in 1900. Fortunately for the Company, the prices of raw materials and labor did increase about this time and enabled the officials to throw dust in the eyes of the public. Furthermore, it must be remembered that in February, 1899, the National Steel Company was formed and linked with the Tin Plate Combination. On what terms the latter received steel cannot be stated, but it is claimed that the two companies could share extraordinary profits and thus prevent any undue appearance of monopoly in either.¹ Profits went into the same pockets.

In this discussion of profits no allowance is made for the economies and advantages the Combination was supposed to secure. Certainly if there were any, the consumer did not benefit.

The American Tin-Plate Company was able to maintain prices in this manner because of the existence of the duty of 1.5 cents per pound on tin plate. A comparison of Welsh and American prices during 1898, 1899, and 1900 shows how the Trust took advantage of the tariff. In 1898, the last year of the period of competition, the average monthly difference between the prices in America and Wales was 46 cents. The average monthly difference in 1899 was \$1.38 and in 1900, \$1.26. During this period of monopoly the American price was high relatively to the Welsh, and the difference approached the amount of the duty. (See chart, p. 88.) Of course, it must not be supposed that the existence of the duty enabled the Trust to raise prices as it did; it merely protected the Trust from foreign competition. Ability to increase prices depended on the nature of the

¹ B. W. Holt, *The Tin Plate Trust* (pamphlet).

demand for tin plate. Since this demand was large and increasing the Combination was able to take advantage of it and increase prices about sixty per cent. But this price policy involved a slowing-up in the rate of growth of production, for the figures show that tonnage output expanded more slowly during this period of monopoly. (See p. 15.)

The balance-sheets of the American Tin-Plate Company for 1899 and 1900 are very interesting, although they are hopelessly meager and unintelligible. They are reproduced below to show how mysterious balance-sheets may be.¹

Balance-sheets

	<i>December 31</i>	
	<i>1900</i>	<i>1901</i>
Assets		
Plants, rentals, etc.	\$43,494,160	\$43,404,508
Mdse. inventory	4,851,544	4,951,925
Accounts receivable	1,468,193	1,518,247
Cash	3,367,246	989,984
Securities purchased	1,127,802	
Other securities	375,000	
	\$54,683,945	\$50,864,665
Liabilities		
Preferred stock	\$18,325,000	\$18,325,000
Common stock	28,000,000	28,000,000
Mortgages assumed	195,000	270,000
Accounts payable	948,424	1,656,239
Surplus	7,215,521	2,613,426
	\$54,683,945	\$50,864,665

Of course, the figures for "Plants, rentals, etc." are pure figments of the imagination to balance the stock issued on the other side of the balance-sheet. In the official statement appended to the balance-sheet of 1899 we read that the surplus of \$2,613,426 was the net earnings of the year after paying three quarterly dividends (\$962,061) on the preferred stock. On this basis the year's profits were \$3,575,487, and the balance after paying the 7 per cent dividend on \$18,325,000 preferred stock was \$2,292,739,

¹ *Commercial and Financial Chronicle*, January 19, 1901, p. 135.

or about 8 per cent on the common stock.¹ No dividend was declared on the common stock.

A comparison of the two balance-sheets shows the increasing strength of the Company. There was only a slight writing-up of plant values; merchandise on hand and accounts receivable decreased; while there were very large increases in cash and surplus. The following official statement accompanied the balance-sheets.²

Net cash assets after payment of dividend on preferred stock and all other charges	
Dec. 31, 1900	\$10,046,360
Ditto Dec. 31, 1899	5,471,693
Increase net cash assets during 1900	4,574,667
Total year's earnings	\$5,857,417

Thus, in addition to the 7 per cent on the preferred stock, the Trust earned in 1900 $16\frac{1}{3}$ per cent on the common. From these profits the directors declared the first annual dividend of 8 per cent on the common stock, after charging off \$1,500,000 to depreciation.

If these figures really represented the true state of affairs in the Company, they show the enormous profits of monopoly. Though one cannot be quite sure that the balance-sheets represented conditions accurately, it is doubtless true that the large earnings depicted were real. The following table summarizes the earnings of the industry during three years and shows the prosperous career of the Trust:³

Year	Earnings
1898	\$2,000,000 — 39 independent firms; 7 per cent on preferred stock.
1899	3,575,487 — 8 per cent on common stock. 7 per cent on preferred stock.
1900	5,750,000 — $16\frac{1}{3}$ per cent on common stock. March 31, 1901, \$6,177,537 — accumulated surplus of the Company

¹ *Commercial and Financial Chronicle*, January 27, 1900, p. 177; April 28, 1900, p. 843.

² *Ibid.*, January 19, 1901, p. 135.

³ Commissioner of Corporations, *Report on the Steel Industry*, part 1,

When it is recalled that the real value of the industry in 1899 was about \$12,000,000, one realizes that the earnings in 1899 were over 30 per cent on the true capital invested, and nearly 60 per cent in 1900. If the earnings for 1898 were \$2,000,000, as stated in the listing application to the New York Stock Exchange, it becomes evident that, even with prices reduced to the Welsh level, American plants were making money. If these earnings are reckoned on the basis of the inflated capitalization, they are not unreasonable, and show that the promoters figured well when they estimated the earning capacity of the monopoly they were creating. (See page 94.)

This account of the finances of the company is just what one would expect after an examination of its price policy. The profitable career of the trust is revealed also by the quotations on the preferred and common stock in the New York Stock Exchange. Common stock fluctuated from \$20 to \$40 until the end of 1900, when the prospects of a dividend caused it to rise above \$50; and in the first four months of 1901, after the declaration of the 8 per cent dividend, it rose to nearly \$80. The 7 per cent preferred stock varied from \$75 to \$100 during 1899 and 1900, but in 1901 rose to over \$120. Thus, in April, 1901, the combined value of one share of common and one share of preferred stock, given for \$100 in cash value in December, 1898, was about \$200.

All the accumulated evidence of price policy, earnings, and market quotations shows that the American Tin-Plate Company exploited its monopoly power and the Dingley Tariff to the fullest extent.

So profitable was the career of the Trust that it was deemed a desirable constituent of the United States Steel Corporation and was absorbed into the giant concern in March, 1901. A further inflation of capitalization accom-

July 1, 1911, p. 135. Earnings for 1898 were given in the listing application of the Company to the New York Stock Exchange.

Quotations of common and preferred stock of American Tin-Plate Company¹

	1899		1900		1901	
	Common	Preferred	Common	Preferred	Common	Preferred
Jan.						
Feb.	37½-44½	93-99½	27½-34½ 41½-36½	80½-83 81-84	55-65½ 56½-79	87-91½ 88-102
Mar.	38-45½	93-97	30-34	81½-83	Trust's Receipts 71-74½ 75-78	
Apr.	41½-52½	88-96	25-34½	78-84½		
May	33-48½	81½-91	21-27½	72½-79	98½-118½ 118½-121	
June	34-42	81-86	18-23½	70½-74		
July	40½-44	84-88	19-24½	74-80½		
Aug.	33½-40	89-91½	22-30	78-80½		
Sept.	37½-44½	85-90½	24-29½	77-81		
Oct.	31½-39	82-86½	26½-35½	79½-84		
Nov.	31½-35	82-84	32½-45½	82½-87½		
Dec.	26-34½	74-83½	41½-57½	87½-92		

March 31, 1901, \$6,177,527 — accumulated surplus of the Company

¹ Commercial and Financial Chronicle.

panied the absorption into the Corporation, raising it to \$63,506,250. For each share of preferred stock held in the American Tin-Plate Company, the owner received \$125 of preferred stock in the Steel Corporation, and for each share of common stock, \$20 of preferred and \$125 of common in the new combination.¹ Two years later, the Steel Corporation merged the American Tin-Plate Company and the American Sheet-Steel Company into the American Sheet and Tin-Plate Company.² The American Sheet-Steel Company purchased the Tin-Plate Company and reduced its capitalization to the nominal figure of \$25,000. Since the two industries are similar in nature, their consolidation permitted much better coördination of sheet and tin-plate mills than was possible under their separate operation. Separate reports for the American Tin-Plate Company and later the American Sheet and Tin-Plate Company have not been forthcoming, so that we cannot examine the course of earnings since the absorption into the Steel Corporation.

Considering its dominating power at the beginning of its career, the policies it adopted to fortify its position, and the economies its organization was supposed to secure, the decline of the relative importance of the Trust in the tin-plate industry since 1900 may evoke surprise. The following table shows the percentages of the production of tin and terne plate in the United States turned out by the American Tin-Plate Company as a constituent of the United States Steel Corporation:³

¹ *Commercial and Financial Chronicle*, March 2, 1901, p. 440.

² Commissioner of Corporations, *Report on the Steel Industry*, part I, p. 135.

³ *Ibid.*, *Report on the Steel Industry*, part I, 1911, p. 56.

Tariff Hearings, vol. 2, Committee on Ways and Means, 60th Congress, 2d Session, 1908-09, House Doc., vol. 140, pp. 1900-05.

Tariff Hearings, vol. 2, Committee on Ways and Means, 62d Congress, 2d Session, 1912-13, House Doc., vol. 128, p. 1130.

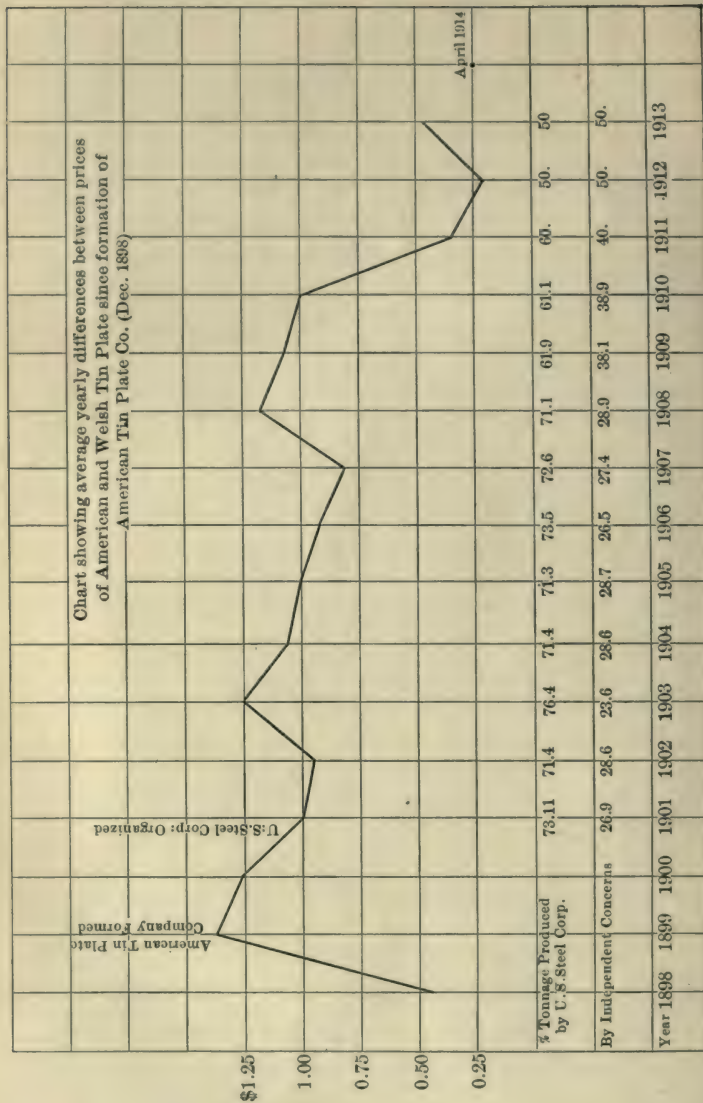
*Steel Corporation's share in the United States' production of
tin plate*

1901	77.31	1907	72.6
1902	71.4	1908	71.1
1903	76.4	1910	61.1
1904	71.4	1911	60.0
1905	71.3	1912	60.0
1906	73.5	1913	50.

In 1900 the American Tin-Plate Company was almost a complete monopoly; to-day it produces only 50 per cent of the tin-plate output of this country. The obvious explanation is that monopoly *per se* in this industry is not necessary for the most efficient methods of production. Monopoly combined with unfair methods of competition, such as factors' agreements, price discriminations, subsidies to makers of machinery, etc., might have been able to maintain itself, but since the American Tin-Plate Company was unable to prevent the rise of competitors, its initial monopoly has disintegrated. A fair-sized and efficient plant can be established for, perhaps, \$500,000. With prices ruling high and profits extremely large in the trade, competition was bound to spring up and increase. Moreover, the United States Steel Corporation has always been fair and has pursued the policy of live and let live. For example, in 1901, the Corporation abrogated the restrictive contracts of the American Tin-Plate Company with makers of machinery, and asserted it would depend on good values.¹

But though the table we have just examined shows that there has been increasing competition as to production, we have designated the period from 1901, which marked the end of the period of absolute monopoly, as the period of quasi-monopoly. While the statistics clearly show the existence of active competition in production, it should be

¹ G. L. Bolen, *Plain Facts as to the Trusts and the Tariff*, New York, 1903. *Outlook* (New York), October 26, 1901.



clearly pointed out that such competition has not been so evident with respect to prices, where it has been materially modified by the existence of a price policy, described by some as coöperation.¹ To examine into the nature of this policy and to determine the extent of real competition constitute a difficult problem that can be solved only by a careful analysis of all the evidence that can be gathered.

At the outset it is well to trace the course of prices of tin plate since 1900. Referring to the chart (p. 87) of monthly prices, we find that the Trust was unable to continue the very high price of 1900 (\$4.84) and lowered it to \$4.19 in 1901. This price continued for two years, until November, 1902, when it fell to \$3.79. During the next four years the price ruled below \$4. In November, 1906, it became \$4.09 and remained the same throughout 1907. The price in 1908 was \$3.89; in 1909 slightly lower. Throughout 1910 it was \$3.84. During 1911, 1912, and 1913 the price was lower than in any years since 1898, and fluctuated more than it did during the previous twelve years. These three years constitute what has been designated the period of rational competition, the characteristics of which really differ from those of the period of quasi-monopoly. During the years from 1901 to 1911 the price of tin plate was held at a high and steady level. In the panic year of 1907 the price was higher than in any year since 1902 and did not change. In 1910, also, the price was constant throughout the year, although this was a period in which, with the sole exception of standard sections of steel rails, the prices of all iron and steel products declined.²

It is important to note the relation of the price of American tin plate to that of Welsh tin plate since 1901. References to the charts that have been constructed will show that the difference between the American and Welsh

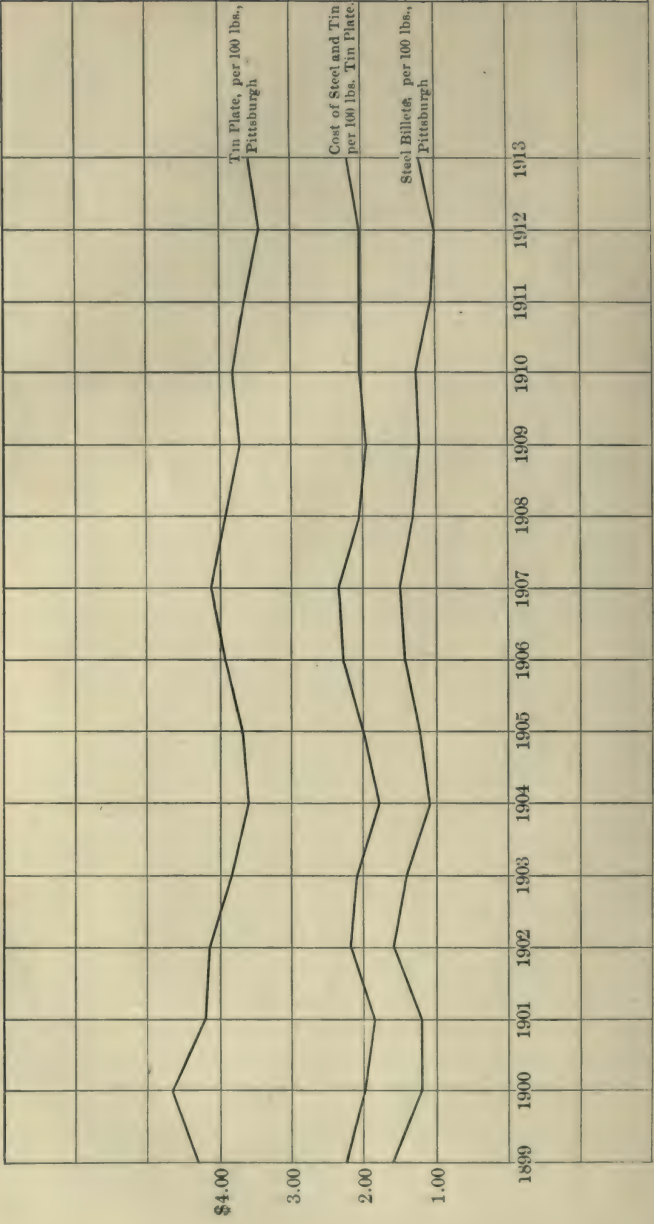
¹ Commissioner of Corporations, *Report on the Steel Industry*, vol. 1, p. 57.

² *Iron Age*, January 5, 1911, p. 64.

prices hovered around \$1 per box of 108 pounds until 1911, when it fell to 36 cents. Then, in 1912, it was 22 cents, but in 1913, 48 cents. Again we note the contrast between the last three years and the previous twelve. The explanation of the increase of the margin in 1913 is found in the severe depression that engulfed the Welsh trade and sent prices down to a low level. If this misfortune had not overtaken the Welsh industry, the difference between prices in this country and in Wales would have been obliterated.

Now we may turn to a detailed examination of American prices and costs, and trace the fluctuations of the margin between the selling price of the finished product and the cost of raw materials. Unfortunately we have not a complete set of figures showing the labor cost in each year, and so we shall have to devote most of our attention to the margin over raw materials. The striking characteristic of this margin from 1902 to 1911 is its constancy, for it averaged about \$1.75. During these years, however, labor cost was falling and output was expanding rapidly, so that one would naturally expect a decline in the margin. This did not come, however, until 1911, when the margin fell to \$1.60; in 1912 it receded to \$1.43, and in 1913 to \$1.32. Here, again, we note the change following 1910. The margin over raw materials and labor cost is incomplete, but instructive. Note that the high margin of 1900 could not be maintained, and was followed by one that averaged about \$1 until 1906. The next corresponding margin is for 1913, and only 72 cents, about equivalent to the margin back in the competitive days of 1898.

The chief fact to be remembered in this set of perplexing figures is the change that occurred in 1911. During the period which is called the period of quasi-monopoly and extends from 1902 to 1911, the price of American tin plate was held at a high and steady level, was usually a dollar higher than the Welsh price, and yielded a constant margin over cost of raw materials. But since 1910 the price has



fallen and approached the Welsh price, and the margin has diminished. Now it becomes apparent why the last three years have been marked off as constituting a period of rational competition.

There can be no doubt that until 1911 the price of tin plate was controlled and maintained by coöperative agreement. During this period of quasi-monopoly the Trust continued to produce about 70 per cent of the annual tonnage (perhaps by agreement also) and the independent manufacturers did not threaten serious competition. The testimony of a former officer of the American Tin-Plate Company describes the policy of price coöperation.¹ The annual meetings of the tin-plate manufacturers took place in Pittsburg and generally occurred after the "Gary dinners." There the manufacturers talked over prices and came to an agreement as to the common figure to be established. Nor was this price generally the lowest one suggested at the meeting. If, after the agreement was made, it was suspected that any member was violating his agreement, his conduct was investigated and pressure brought to bear on him to make him mend his ways.

Conditions were such in the tin-plate industry that these "gentlemen's agreements" were efficacious. This form of coöperation was generally abandoned in the nineties in favor of holding companies and corporations, but in the present century the movement has been back toward "gentlemen's agreements." In the tin-plate industry the Steel Corporation produced seventy per cent of the yearly tonnage, and it was interested in maintaining a high, steady level of prices. Neither runaway markets nor falling markets were to its liking, and with its vast resources and power it could dominate the situation. Moreover, there were only ten or twelve independent manufacturers, and they have been "decent" gentlemen. They have not sought to cut one another's throats, and have maintained their

¹ *United States vs. United States Steel Corporation*, vol. II, p. 580 ff.

agreements. Consequently, the price of tin plate remained high and steady during the period of quasi-monopoly.

Since 1910, however, competition has been real and keen. The share of the independents has increased to more than fifty per cent of the trade, and the course of prices has been downward. Still, the market has never become demoralized through rash and destructive competition. That is why we have called the last three years a period of rational competition. It is generally understood that the Steel Corporation has given up its attempt to control prices in order to avoid prosecution and the reproaches of public opinion. The Company, it is said, is content to follow the independents, who have been reasonable. Although prices have descended, it is quite likely that the manufacturers still understand each other pretty well.

During the period of quasi-monopoly the factor that enabled the manufacturers to maintain the high level of prices, though production was increasing by leaps and bounds, was the ever-enlarging demand for tin plate. Its application to new uses, and the increasing demand for old uses, continued to absorb greater and greater quantities. The slackening of this demand in the last two or three years has helped to send prices down. Increasing exports show that the domestic market has reached its full expansion for the present.

When the attempt is made to draw any definite conclusions as to the profits that have been made by the Steel Corporation in this industry, figures are lacking. According to the statements of various independents, tin-plate making has been for them extremely profitable.¹ The enormous expansion of output and the growth of competition testify to the prosperity of the industry. In the "Report of the Commissioner of Corporations on the Steel Industry, it was set forth that the average book cost of a hundred-

¹ *Tariff Hearings*, vol. II, Committee on Ways and Means, 60th Congress, 2d Session, House Doc., 1908-09; vol. 140, p. 1904.

pound box of tin plate for the Steel Corporation from 1902 to 1906 was \$3.18. This figure includes large intermediate profits, but it is useful as the basis of an estimate of the Trust's profits during those years. The table on page 101 contains the average selling price during these years, the number of boxes produced by the Corporation, and the profits. Of course, these figures are only averages and may not give accurate results.

<i>Year</i>	<i>Selling Price</i>	<i>Cost</i>	<i>Profit per box</i>	<i>Boxes</i>	<i>Earnings</i>
1902	\$4.12	\$3.18	\$0.94	5,000,000	\$4,700,000
1903	3.84	3.18	.66	6,500,000	4,240,000
1904	3.64	3.18	.46	6,500,000	3,000,000
1905	3.69	3.18	.51	7,000,000	3,570,000
1906	3.89	3.18	.71	8,000,000	5,680,000

These earnings were exceedingly good, even when based on the inflated capitalization. Independent concerns, too, have been very prosperous.

Summary

Altogether the formation of a combination in the tin-plate industry has exerted a healthy influence in its growth. The American Tin-Plate Company acquired at its birth thirty-nine plants, but it has dismantled more than fifteen that never should have been built. The keen competition of the later nineties caused inefficient plants to be built in unfavorable locations. Undoubtedly, had not the Trust been formed, many of these would have been pushed to the wall especially by the increase in the cost of raw materials.¹ Concentration of the industry in fewer and larger plants has been thoroughly carried out by the large Company, and has placed the industry on a higher plane of efficiency. The independent plants that have been built

¹ F. L. McVey, in Ripley, *op. cit.*, p. 309; *Tin and Terne*, January 12, 1899; *Report of the Industrial Commission*, 1900, testimony of D. G. Reid, vol. 1, p. 878 ff.

since the formation of the Trust are, most of them, of the first order.

Technical progress in the plants of the American Tin-Plate Company, and later of the Sheet and Tin-Plate Company, has always been marked. It was the Trust that exploited the Donner process, and it is said that the Steel Corporation devoted \$1,000,000 to perfect the Bray Mill.

The domination of the trade by the large Company has tended to eliminate fluctuations in the trade. During the period of quasi-monopoly there were no runaway markets and no depressions. In 1907, for example, the price of tin plate was kept at the same figure throughout the year. Control of the trade by a policy of coöperation has certainly resulted in a high level of prices, but it has prevented fitful and unhealthy movements. This statement applies since the absorption of the American Tin-Plate Company into the Steel Corporation; the former mulcted the consumers when it enjoyed its monopoly.

The history of the combination movement in the tin-plate industry presents the problem of monopoly in its various aspects. Starting as a complete monopoly the American Tin-Plate Company has receded in importance, until to-day it produces only fifty per cent of the output of the industry. Certainly bigness does not secure additional efficiency in tin-plate manufacturing.¹ The American Tin-Plate Company had absolute control of the field in 1899, and if a combination of all the plants in the trade constituted the most efficient method of pursuing it, then the Trust would still be alone in the field. But since its absorption into the Steel Corporation, it has been fair and has not sought to suppress competition by unfair means. Perhaps, if monopoly had been firmly buttressed by the policies of restriction the American Tin-Plate Company first attempted to pursue, monopoly might still dominate the

¹ *United States Steel Corporation Investigation Committee Report*, 62d Congress, 2d Session, House Doc., no. 1127, p. 23.

field. The large, well-managed, modern plant of an independent firm can compete successfully with the large Company, and the increasing importance of independent concerns has finally lowered the price of tin plate and brought about a condition of rational competition in the trade.

The American Tin-Plate Company must not be regarded as the creation of the tariff. Its formation resulted from unhealthy competition. To be sure, not a single firm had failed in the period of drastic competition in the nineties and profits were still good, but there were altogether too many firms in the field. Later the inefficient and poorly located plants would have tended to demoralize the trade in the scramble to secure markets. Though not the creature of the tariff, the Trust did not fail to court the high duty and to make the public pay dividends on a preposterous capitalization.

Mr. Veblen and some other economists claim that this process of watering has really no effects at all; the market puts the true valuation on the stock irrespective of capitalization.¹ Though this may be true, an excessive over-capitalization facilitates the concealment of huge monopoly gains, as it did in the case of the American Tin-Plate Company. If the Trust had been capitalized for its true value, some inquisitive persons would have looked into profits of fifty and sixty per cent. Moreover, the process of over-capitalization was the source of exorbitant promotion profits, and the basis of large individual fortunes, reared on monopoly and speculation. For those newspaper writers and financial editors who believe that high prices are the result of over-capitalization, it may be said that the American Tin-Plate Company could charge high prices for tin plate because the demand for the commodity was continually on the increase. Desire to pay dividends on watered stock would not have enabled prices to be put

¹ T. Veblen, *The Theory of Business Enterprise*. New York, 1904.

higher, unless the nature of the demand for the commodity permitted the maintenance of a high level of prices in the face of rapidly augmenting output.

But the old order has changed. The duty on tin plate has been reduced by the Underwood Act to fifteen per cent *ad valorem*, and public opinion would no longer tolerate strict control of prices. The régime of rational competition under Government supervision is the solution of the trust problem in the tin-plate industry. Moreover, control of prices was bound to disintegrate during the last three years because of the change in the status of the American tin-plate industry. It has occupied the entire domestic market and is rapidly coming to the front as a great exporter. With these developments we deal in the next chapter.

II. ASSOCIATIONS AND COMBINATIONS IN WALES

Frequent attempts have been made in the Welsh tin-plate industry to effect concerted action among the manufacturers. In 1895 the Tin-Plate Manufacturing Board of Control was set up to reduce output by one third and to keep up prices. This central agency was abandoned in the following year. Then attempts were made to interest the many firms in the common aim of developing new markets, but they were unsuccessful.¹ The presence of a large number of small and weak firms continually hindered combined action. Following the internal disturbances in Russia in 1906, manufacturers were able to effect an agreement for a stop-week in order to assimilate production to the reduced demand. But at that time it was written, "The number of manufacturers in the tin-plate industry is still too great, their circumstances too diverse, and their interests too discrepant for effective combination to regulate their industry."

¹ H. W. Macrosty, *The Trust Movement in British Industry*, London, 1907, p. 53.

Since then Wales has enjoyed a period of unusual prosperity because of the increasing demand for tin plate. Then developments in the United States helped to reverse the situation and to produce depression, for the Americans took the reëxport and Canadian markets from the Welsh. The losses of these markets meant that Wales must reduce her output, but individual action among manufacturers could not effect the reduction. So for over a year past the movement for combined action has been progressing under the leadership of the principal manufacturers, but it was only in February, 1914, that an agreement was reached. It took many months to round up the numerous little firms. In essence the consolidation plan is a pooling of production.¹ Each firm is allotted a certain percentage of the production of the country, and it cannot exceed that limit. For any excess it must pay so much into a common fund; on the other hand, if it does not produce up to the limit, it may draw so much from the common fund. In the United States this is known as a "paying in and taking out" pool. The sole purpose, according to the parties, is to assimilate supply to demand, but of course the ultimate aim is to control prices.

The vicissitudes of the tin-plate trade in Wales have led many of the leading manufacturers to join the ranks of the Tariff Reform Party (they do not like the name "Protectionists"), led by Mr. Joseph Chamberlain. While they may admit the benefits of free trade, and indeed many of them have made fortunes under that system, they maintain that England is losing ground in an unequal struggle. Free trade is a sound policy, they say, when it is universal; ruinous when practiced by one country. The Reformers point to Germany and the United States, with populations respectively of 66,000,000 and 100,000,000 people, and assert that the manufacturers of those countries have not only the enormous home market, but also the English

¹ *Times* (London), January 27, 1914; February 17, 1914, p. 18.

market of 44,000,000 people. On the other hand, the poor English manufacturers have only the home market. So the Tariff Reformers want a system of imperial preference which will secure to England the markets of the Empire. That is why the tin-plate manufacturers support the movement; they wish to win back the Canadian market by a fiscal system that will favor Welsh tin plate. Thus, while legislation has been reducing the duty on tin plate in the United States, Welsh manufacturers have been agitating for a protective system that will prevent the Americans from robbing them of their markets.

The working of international trade has affected the Welsh industry in another way.¹ During the past ten years or so Germany, France, and the United States have been sending tin-plate bars to Wales in large quantities.² Tin-plate manufacturers have purchased these foreign sheet bars at lower prices than they could secure the domestic bars and have caused a depression in the sheet-bar industry in Wales. In order to check the effects of foreign dumping the sheet-bar manufacturers have sought to control the tin-plate works through stock ownership or community of interests, and there has resulted an integration of the two industries. The sheet-bar firms have been compelled to link themselves with the tin-plate manufacturers in order to preserve their market. Some Welsh tin-plate manufacturers claim they would be swept from the board were it not for the importation of foreign tin-plate bars which enables them to secure their raw material at a low price.

Associations in Wales are measures of self-protection rather than of aggression. The present depression is very real and is accentuated by the participation in the trade by so many small and inefficient plants, which always lead the way to demoralization. The tin-plate production of Wales could be carried on more efficiently by probably

¹ See article by J. H. Jones, *Economic Journal*, June, 1913, p. 182.

² *Iron Age*, January 17, p. 27.

half the number of the firms in the field, and a combination movement that would close all the small and inefficient plants would be a healthy and beneficial trade development.

This statement is not adduced as a justification of monopoly as the most efficient form of industrial organization; but it must be granted that a combination, such as the American Tin-Plate Company, does conserve capital and energy. True, the numerous inefficient plants may be submerged by natural developments, but a combination effects the reorganization with less friction. This, however, does not signify that efficient independents cannot compete with a combination, and that the natural evolution of industry is toward monopoly.

CHAPTER VI

IMPORTS AND EXPORTS

SINCE 1898 the net imports of tin plate into the United States have been negligible. Wales had been sending 60,000 and 70,000 tons every year until 1911, but these imports were not for domestic consumption. They were purchased by concerns, such as the Standard Oil Company, which used them to pack their products for exportation. Under the drawback provisions of the customs laws, the importer received back ninety-nine per cent of the duty paid when the tin plate was imported. Thus for the reëxport trade the Welsh product was practically duty-free, and since it generally sold about one dollar per box less than the American tin plate, great canning concerns found it to their advantage to purchase the foreign goods. But all the while the American tin-plate firms were increasing their output, and in 1911 they took the export trade from the Welsh. The table on page 109 shows the reversal that has occurred during the last three years.

During the years from 1897 until 1911 the net imports of tin plate into this country were less than 100,000 tons.¹

In 1911 imports dropped to 13,000 tons; the following year, they were insignificant; and in 1913 they were about 20,000 tons. The Welsh still share to a slight extent in the reëxport trade, but it is a mystery to them why the United States Steel Corporation allows them to. One manufacturer has stated that the Steel Corporation simply suffers the Welsh to participate to the extent of a few thousand tons.² Undoubtedly the chief factor in this reversal of trade was

¹ Part consisted of specialties.

² R. B. Thomas, of Richard Thomas and Company, Limited, London.

Imports and reexports of tin plate in the United States

<i>Year</i>	<i>Imports</i> ¹	<i>Reexports</i> ²	<i>Excess of Imports</i> ³
1898	65,388	61,561	15,000
1899	68,546	54,000	6,000
1900	58,040	56,000	10,000
1901	75,822	52,000	—4,000
1902	65,142	51,000	32,000
1903	50,674	54,000	5,000
1904	71,862	49,000	7,000
1905	63,050	67,000	4,000
1906	61,518	56,000	100
1907	58,920	45,000	16,000
1908	60,602	70,000	—8,000
1909	64,446	52,000	200
1910	73,619	63,000	5,000
1911	13,994		
1912	2,135	1,742	393
1913	21,000		
1914	15,529		

¹ Parliamentary Documents, *Reports of Trade and Navigation*.

² *Statistical Abstract of the United States*.

the fall in the price of tin plate in this country. We have already traced the descent of prices sufficiently to know that in 1911 and 1912 the American and Welsh were practically on a level. Thus, there was no advantage in purchasing Welsh tin plate. In 1913 the disparity between the prices was a little more, due to depression in Wales, and so imports increased somewhat. Speaking broadly, however, the American manufacturers, particularly the Steel Corporation, have taken the reexport trade from the Welsh.

In the chapter on "Labor," account was given of the arrangement between the Amalgamated Association and the United States Steel Corporation, whereby the latter hoped to capture the reexport trade. The hot-mill workmen were to grant a rebate of twenty-five per cent of their wages on tin plate sold to exporters in competition with the Welsh. It was noted also that this rebate plan enabled the Steel Corporation to dispose of some twenty thousand tons annually. The obvious significance of this scheme is that

under the prevailing scale of wages and conduct of the industry the Steel Corporation was unable to meet the Welsh on even terms. Wages had to be nibbled at, and the Amalgamated chafed under the rebate plan, which was abandoned in 1907.¹

Not until 1911 did the Americans capture this branch of the trade from the Welsh, and then by the natural development of the industry. The better conduct of the trade, lower wages, and the enormous growth of output lowered costs until the manufacturers were able to take the trade at their will. The industry in this country has exploited thoroughly the huge domestic market, and in the last two or three years has appropriated through necessity other markets lying at hand. From a purely domestic industry it has become one striving for the markets of the world.

Both independent manufacturers and the Steel Corporation share in this reëxport trade, and sell their products at something below the market price. Of course the Standard Oil Company and the United States Steel Corporation "understand" each other pretty well, and it is not to be wondered at that the Oil Company buys its tin plate from the Steel Corporation, and at favorable prices.

Export trade

Although it is rash to hazard predictions, it does not take a prophet to observe that we are on the threshold of a great international struggle for markets in the tin-plate trade. An account of the growth of the American export business will help to explain the situation. The table below presents the figures showing the exports of tin plate from the United States since 1898:—

¹ During this time average labor cost of a box of tin plate for the United States Steel Corporation was 82 cents; for Welsh producers, probably 60 cents. This discrepancy in money costs does not mean necessarily that the Welsh produced with a less expenditure of energy. America is a country with a high level of prices, comparatively speaking.

*Exports of tin plate from the United States*¹

<i>Year</i>	<i>Tons</i>	<i>Year</i>	<i>Tons</i>
1899	102	1907	20,000
1900	159	1908	17,000
1901	700	1909	5,000
1902	1,200	1910	13,000
1903	800	1911	35,000 ²
1904	4,000	1912	81,000 ²
1905	11,000	1913	74,710
1906	12,000	1914	60,632

The table shows that until 1911 exports of tin plate from the United States were neither large nor regular. From 1899 to 1911 the total amount was only about equivalent to the exports for 1912 alone. During these years exports consisted of surplus product that was dumped in foreign countries at prices below the domestic price. Since 1910, however, the character of this trade has changed. As was said in the discussion of the reëxport trade, the American industry has exploited the domestic market and now must turn her attention to exports in order to dispose of her growing production. If the output in America increases in the next few years as it has in the past, American manufacturers must enter more and more of the markets that now belong to the Welsh. The industry in this country has burst the confines of the domestic trade and is rapidly becoming more and more formidable in the markets of the world. Already, the exports from this country are approaching 100,000 tons per year, and unless the world's demand for tin plate increases, or new markets are opened up, the Welsh industry will experience again the crushing depression of the nineties. Wales is already feeling the effects of the American attack, for the present depression is due to the appropriation by the Americans of the reëxport trade and the Canadian market. Every increase of 100,000 tons

¹ *Reports of Commerce and Navigation of the United States.*

² *Ironmonger, Metal Market Year-Book, 1914.*

of exports from America means that Wales loses twenty per cent of her export trade, unless new markets are opened. Small wonder, then, that the Welsh manufacturers are agitating for a system of imperial preference. They fear they will be swept from the board.

The United States exports tin plate to South America and Asia, but principally to Canada. For years the Welsh sold to Canada, but in the last few years the Americans have taken almost the entire trade. Exports to Canada from Wales were over 20,000 tons annually, until 1911, when they declined to 12,000 tons.¹ In 1912 they amounted to 7000 tons, and some 9000 tons in 1913. The United States exported over 45,000 tons to Canada in 1912. Both independent producers and the Steel Corporation participate in this Canadian trade.

Welsh producers claim that all the American exports to Canada are dumped goods, yet such is not the case. It is true that American tin plate has been sold in Canada, and still is to a large extent, below the domestic price. The Stanley Committee cited the example of the tin-plate export trade to illustrate the Steel Corporation's foreign policy and to show how it was mulcting the home consumer.

Year	Duty per ton	Average price * domestic 100 lbs.	Average U.S. Steel Cor- poration Ex- port price *	Difference per ton be- tween foreign and domestic fields	Average price † Wales per 100 lbs.
1906	\$33.60	\$3.69	\$2.85	\$18.91	\$2.98
1907	33.60	3.90	2.40	11.20	3.32
1908	33.60	3.70	2.90	17.92	2.78
1909	33.60	3.50	2.85	14.56	2.70
1910	26.88	3.60	3.04	12.56	3.00

* *United States Steel Corporation Investigation Committee Report*, 62d Congress, 2d Session, House Doc., no. 1127, pp. 23-24.

† Interpolated.

This table shows that the American tin plate has sold in Canada fifty cents and sixty cents below the domestic price in order to meet the Welsh competition. The Stanley

¹ Parliamentary Documents. *Reports of Trade and Navigation*.

Committee concluded that the only cause of this difference was the high duty on tin plate, which sheltered the Trust, and that the difference represented the injury done to the home consumer. This is altogether too drastic a statement, for it neglects the fact that previous to 1911 exports to Canada were small and irregular, and dumped. The price received may not be a criterion of what would have been a fair price in the United States for all concerned.

To-day, however, and during the last two years also, the exports to Canada are real exports. Some of the independent manufacturers say that they receive the same price for their product in Canada as they do at home. They claim that the Canadians prefer to buy in this country because they can communicate with manufacturers easily and quickly, and receive prompt deliveries. In short, the Canadian market belongs in the nature of things to the Americans. It must not be supposed, however, that all American exports command the same price in Canada as in the home market. These same manufacturers quoted above admit that the bulk of the trade is carried on at a lower price than prevails in the United States. They export to inland points, where they receive the full price, but the bulk of the exports goes to the seaboard. When the prices of Welsh and American goods were about on a level during 1911 and 1912, the necessity for a difference in price was gone, or very much diminished, but at the present time, with the Welsh product selling at about \$2.90 per one hundred pounds, and the American at \$3.25, the latter sells in Canada probably thirty or forty cents below the home-market price. These differences always depend on the relative prices of Welsh and American tin plate.

The reëxport and export business now absorbs over 150,000 tons of tin plate, or about fifteen per cent of the American production. It is unreasonable to suppose that this great quantity is sold below cost, even though below the domestic price, and that the exports, now approaching

100,000 tons, represent abortive dumping. Previous to 1911, when the exports were small and irregular, they were the result of a dumping policy, but to-day the increasing quantities sent to Canada and other countries are normal exports.

The story of the capture of the reëxport trade and the Canadian market by the Americans illustrates well the present position of the industry in this country. The United States has grown to be the largest tin-plate producer in the world, and now that she has exploited the home market, she is turning to the markets of the world and advancing to the front as a great exporter. No fact can show better than this that the tin-plate industry found a favorable environment in America and has enjoyed a marvelous growth.

CHAPTER VII

CONCLUDING REMARKS

WHAT light does the history of the tin-plate trade in the United States throw on the policy of "protection to young industries"?

Advocates of protection point with pride to this case and then extol the virtues of their views. This country, they say, is now the greatest producer of tin plate in the world, and no longer pays millions of dollars annually to Wales. Many thousands of work-people are employed in the new trade, which keeps thousands busy in other dependent lines of work. But the most important advantage of all, they assert, is the low cost at which Americans are procuring tin plate. Were Wales still supplying all the markets of the world, they believe the price would be much higher.¹

The general trend of the argument for protection to young industries is that it is advantageous to encourage by legislation a branch of industry that may be pursued profitably, that is sure to be established, but which needs some artificial stimulus to overcome initial obstacles that are accidental and temporary.

The examination of the conditions that gave birth to the tin-plate industry showed that they fulfilled perfectly the postulates of the protectionist argument. In the first place, the rolling of steel into black plate for the purpose of tinning is not essentially different from the rolling of sheets, which had been carried on successfully in America previous to 1890. The other processes through which black plate must pass to become tin plate are simple and easily learned,

¹ *Tariff Hearings*, Committee on Ways and Means, 62d Congress, 3d Session, House Doc., vol. 128, no. 1447, pp. 1113-41.

and have offered a fertile field for the exercise of American ingenuity and inventiveness. Although the manufacturers lacked thorough technical knowledge of tin-plate making, they had a trade partially similar and could easily learn the other processes.

Moreover, as this country was rapidly coming to the fore as the greatest steel community in the world, steel, the chief raw material of the tin-plate industry, was becoming cheap and abundant. In addition, the United States was the greatest market for tin plate in the world. Thus, in 1890, a country rapidly advancing in steel production was importing a steel product to the amount of over 300,000 tons annually. It was only natural that steel producers should seek to capture this market.¹

Aside from these fundamental favoring factors, the United States possessed an excellently situated steel-producing community, with plenty of coal and power; an energetic body of manufacturers constantly seeking new enterprises; and a growing and industrious population.

With all these favorable conditions, say the protectionists, it is wise and advantageous to grant Government assistance to the new industry to help it overcome all temporary obstacles. Then, when the industry has attained its growth, and is dispensing all the advantages of a domestic manufacture, the duty may be lowered or removed.

Now, it must be admitted that the high duty of 1890 stimulated the growth of the tin-plate industry in the United States. It made capital and *entrepreneurs* bolder in entering the trade, and made the industry develop faster than it would have under a free system. The high profits and security fostered by the tariff stimulated competition, which in turn quickened technical progress, brought better organization, and lowered costs. Falling prices increased the demand for tin plate and led to greater and greater production. Here, then, is a case to which the advocates of

¹ *Iron Age*, May 14, 1896, p. 1138.

protection may turn and claim some advantage for their system. The security and high profits fostered by the successive duties on tin plate undoubtedly quickened the growth of the industry.

This argument for protection — that it enables young industries to overcome initial difficulties — has been advanced with extreme vigor and earnestness in debates on tariff policy, but it is to be noted that its premises diminish its importance, because they admit that the industry was bound to be established anyway. The tin-plate industry was sure to develop in this country as a final branch of the steel industry, and just about 1890 a remarkable confluence of causes occurred to produce this development. The high duty of the McKinley Act was an expression of the times, and a bit of very timely legislation, behind which the causes already at work produced their results rapidly. During the first four years of the industry's growth, the cost of the protective policy to the American people was large, but in the following period of lower duty and internal competition, this cost was totally abolished. By the end of 1898 the price of tin plate was lower than it had ever been before. Since the end of the period of competition, however, a trust and price agreements were able to take advantage of a high duty and to maintain a high level of prices. Of late years the price has become competitive, and is lower than it was in the days of Welsh monopoly. Undoubtedly this development would have come in the course of time without the high duty, and its abuses. It is hard to balance considerations and decide anent the seeming advantages of the protective policy.

But though it be granted that the high duties stimulated the growth of the industry, protectionists must not commit the folly of attributing the industry entirely to the McKinley Act. Never would there have been tin-plate making in America, they say, had not the high duty of 1890 been put in force. They forget all that was said in 1890 about

the factors favoring the establishment of the industry, and overlook the elements of progress that have fostered its growth. There is one cry: before 1890 smaller duties did not produce an industry, but as soon as the McKinley Act went into effect the industry grew apace; *post hoc ergo propter hoc*. Since salt-cellar and pepper-pots usually go together on the dinner table, if you put a salt-cellar there, then, *ipso facto*, a pepper-pot must appear.

So it must be remembered that the McKinley Act was only an element in a confluence of causes that resulted in the introduction of tin-plate making into the United States. Since the early years of the industry, technical progress, an efficient labor supply, better conduct of the trade, and more economical organization have been more important factors in the growth of the industry than the tariff. The periods of most rapid growth were those in which the lowest duties were in force, from 1894 to 1897 and from 1909 to the present time.

Now that the infancy of the industry has passed, some manufacturers resort to the "pauper-labor" argument to justify the retention of a duty on tin plate. They present other elements as further justification, but they lay great stress upon the labor phase of the problem. In 1908 and 1912 independent manufacturers appeared before the Ways and Means Committee of the House of Representatives and explained why the industry should continue to enjoy protection.¹ At different times they maintained that 1.2 cents per pound, then 1 cent per pound, and finally 0.85 cent per pound, were absolutely necessary to keep the trade up to its current standard. Their pleas comprise four elements:—

First, some manufacturers have claimed, on a compari-

¹ *Tariff Hearings*, Committee on Ways and Means, House of Representatives, 60th Congress, vol. II, Schedule C, pp. 1900-39.

Tariff Hearings, Committee on Ways and Means, House of Representatives, 62d Congress, Schedule C, January 11, 1913, pp. 1113-40.

son of tonnage rates, that they pay from 34 to 45 cents per box more in wages than do the Welsh. Now, if the duty were removed, or made unduly low, they assert, they would have to reduce this differential and throw the burden on the workmen. During the first fifteen years, or more, of the industry's history in this country, the labor cost per box was probably much higher than the corresponding cost in Wales. In the period of inception, the labor cost in America was \$1.60 per box, according to one manufacturer, and, in 1900, about \$1.¹ The Welsh cost was probably not over 60 cents. From 1902 to 1906 the average labor cost of the Steel Corporation was 82 cents per box, but large reductions have been effected since then.² To-day there is practically no difference between the labor costs in the two countries, for in both this item seems to vary from 55 to 60 cents. While American manufacturers might have justly urged some years ago that their expenses of production for labor were higher than in Wales, their contention has no foundation to-day. Furthermore, if protection maintains the wages of their work-people, they must explain why the tonnage rates for hot-mill labor have fallen 25 per cent, and those of tinmen from the high level of the early period, although high duties were in effect. It is to be noted also that they do not scruple to hire the common laborers of southern Europe, who earn \$1.70 per day.

The second advantage the Welsh producer is supposed to enjoy over his American rival lies in the lower cost of tin-plate bars in Wales. It is claimed that tin-plate bars are generally cheaper in Wales, and that this fact entitles the American manufacturer to at least ten cents' worth of protection per box. At times steel does sell at a lower price in Wales, but it is also true that steel has sometimes been

¹ *Report of the Industrial Commission, 1900, Testimony of D. G. Reid, vol. iv, p. 987 ff.*

² *Commissioner of Corporations, Report on the Steel Industry, part II, 1912, p. 34.*

cheaper in the United States. Generally, however, prices in the two countries are about the same. The United States can produce steel just as cheaply as any country, and exports tin-plate bars in large quantities to Wales. Germany does also, and France occasionally. These importations of sheet bars into Wales have at times kept the price of the product unduly low and injured the Welsh producers. Integration of sheet-bar and tin-plate plants has resulted from these trade developments. Speaking broadly, it may be said that the American manufacturers procure steel just as cheaply, if not more so, than the Welsh.¹

Thirdly, it is alleged that the interest and maintenance charges in the American industry are larger than in Wales, because the former employs more and better machinery, and has more extensive equipment. The latter facts do not warrant the deduction about higher interest charges. When it is recalled that some 35 plants, operating about 370 hot mills, turn out about 1,000,000 tons of tin plate in America, while some 75, operating 450 hot mills, turn out less than 700,000 tons in Wales, it is submitted that the American manufacturers forgot something when they figured that the tariff owed them 13 cents per box in order to keep up their plants.

Finally, the producers of this country claim they are under disadvantages as regards freight rates. Without entering into any corresponding costs for Wales, they assume that the duty on tin plate must include a 40-cent freight ride, which their goods must take to get somewhere. As a matter of fact, about two thirds of the tin plate produced in the country is consumed at the Atlantic seaboard, because so many canneries are located there. The rate per box of tin plate from Pittsburg to New York is 15 cents, which is about equivalent to the transoceanic freight the Welsh pay.

¹ 1913, Welsh steel bars (Bessemer), per ton, \$23.50 to \$22.14, range of prices during year. (*Ironmonger*). United States Bessemer steel billets (Pittsburg), \$28.50 to \$20.00. (*Iron Age*.)

The easiest way to dispose of these fancied differentials is to point to the fact that for the past three years Welsh and American tin plate have not differed much in price. Were it not for the depression prevailing in Wales, there would probably be no difference to-day between the prices. It is a noteworthy fact that steel sheets, whose manufacture is similar to that of black plate, sell regularly in America for less than they do in England, while tin plate has generally sold higher in this country. The explanation of this industrial phenomenon is the difference in the amounts of competition that have existed in the sheet and tin-plate markets.¹ In the former, control of prices by domination and agreements has not existed as in the tin-plate market, and so prices have been competitive and below the prices of similar English products.

To-day, many of the manufacturers are supremely indifferent to tariff considerations. The reduction of the duty to 15 per cent *ad valorem* by the Underwood Act does not disturb them in the least. They say the industry is quite independent of any legislation.

The American tin-plate industry affords an example of an industry built up under protection; the Welsh of one rehabilitated under free trade. It is really a remarkable struggle that gallant little Wales has made to regain her former position, and she has succeeded well. If to-day she is somewhat behind the United States in the industry and is suffering from further attacks from her great rival, free trade is not to be blamed, but the comparative slowness of technical progress in Wales, the extreme conservatism of her people, and the uneconomical organization of the trade in a large number of small plants.

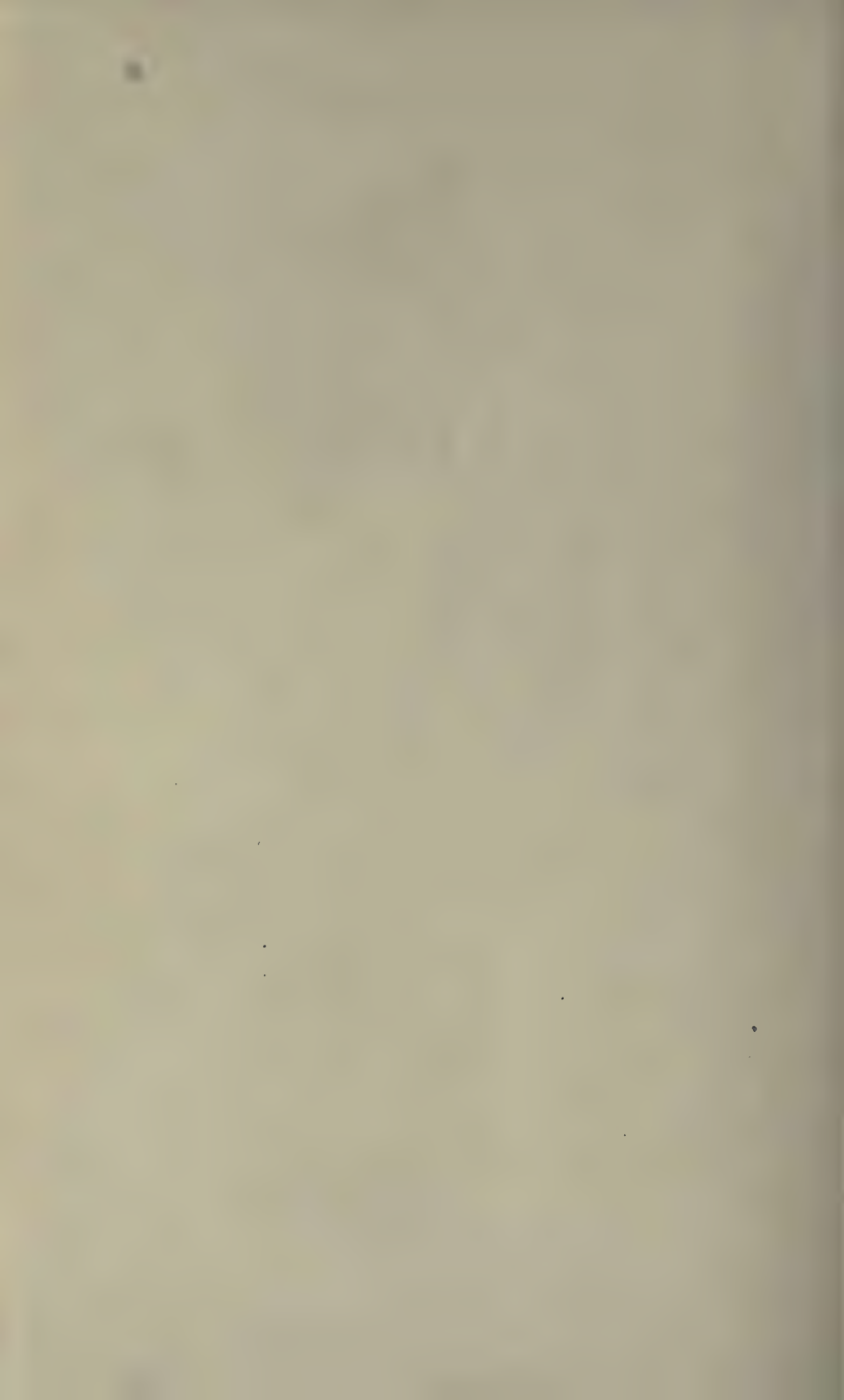
While the immediate future of the Welsh trade appears rather dull, there can be no doubt that the American industry will continue to expand. Large new plants are being

¹ *Iron Age*, January 7, 1904, p. 86; B. E. V. Luty, *Iron Age*, "Metal Market."

built, while old ones increase their output year by year. The manufacture of tin plate found a favorable environment in this country and has enjoyed a marvelous growth. Technical progress, an efficient and amenable labor supply, cheap and abundant steel, and enormous markets, have been the prime factors in one of the most wonderful industrial developments that have occurred in the United States.

THE END

BIBLIOGRAPHY



BIBLIOGRAPHY

MUCH of the information contained in the foregoing pages is based on correspondence with manufacturers; on personal interviews with manufacturers, engineers, and trade editors; and on visits to works both in the United States and in Wales. No pretense has been made to investigate conditions in Germany, France, Spain, and Italy, each of which manufacture a few thousand tons of tin plate, but do not enter into the world's markets. Interest centers around the great industries of the United States and Wales. In fact, this work began originally as a study of the growth of tin-plate making in America, but since this development has been so closely interwoven with events in Wales, it was deemed expedient to make a comparative study of the two industries. The following list names the principal books, trade journals, and Government reports that have been used in writing this monograph.

TECHNIQUE

United States

Iron Age. 1890-1915.

Ironmonger. London.

London Engineer. 1894-1910.

Tin Truth. Pamphlet published by Follansbee Brothers Company of Pittsburg.

United States Census Reports, 1900 and 1910.

Wales

British Trade Journal.

FLOWER, W. P. *History of Trade in Tin and Tin Plates*. London, 1875.

Institution of Mechanical Engineers. London. *Proceedings*.

Iron Age. New York.

Iron and Coal Trades Review. London.

Ironmonger. London.

Iron and Steel Institute. London. *Proceedings*.

London Engineer.

Report on Conditions of Employment in the Manufacture of Tin Plate. E. L. Collis, His Majesty's Medical Inspector of Factories; J. Hilditch, His Majesty's Inspector of Factories, 1912, Cd. 6394.

Report of Her Majesty's Chief Inspector of Factories, 1888.

LABOR

United States

Amalgamated Association of Iron, Steel and Tin Workers. *Western Scales of Prices.* Published by National Lodge, Pittsburg. Bureau of Labor.

Report on Condition of Employment in the Iron and Steel Industry. 1911, 4 vols., C. P. Neill. *Reports.*

Special Report of Commissioner of Labor, 1904, chap. III, "Iron and Steel."

Commissioner of Corporations. *Report on the Steel Industry,* July 1, 1911. 2 parts.

Industrial Commission. *Report on Trusts, 1900, vol. I and XIII. Iron Age.*

JENKS, J. W. *The Trust Problem.*

Trusts and Industrial Combinations. Bulletin of the Department of Labor, July, 1900, no. 29.

Pennsylvania. Annual Reports of the Secretary of Internal Affairs of the Commonwealth.

United States Census Reports.

Wales

Board of Trade (British).

Labour Gazette, 1892.

Collective Agreements. *Report on Collective Agreements between Employers and Work-People, 1910, Cd. 5366.*

Enquiry into Earnings and Hours of Labour of Work-People of the United Kingdom, vi. Metal, Engineering, and Ship-building Trades in 1906, 1911. Cd. 5814.

British Blue-books.

Consular Reports.

Report on Conditions of Employment in the Manufacture of Tin Plate, Cd. 6394, 1912.

British Trade Journal.

Ironmonger. London.

London Engineer.

Times. London.

ASSOCIATIONS AND COMBINATIONS

United States

BERGLUND, A. *The United States Steel Corporation*. New York, 1907.

Commercial and Financial Chronicle.

BOLEN, G. L. *Plain Facts as to the Trusts and the Tariff*. New York, 1903.

HOLT, B. W. *American Tin-Plate Trust*.

Report of the Industrial Commission. 1900.

56th Congress, 1st Session. House Doc. no. 476, part 1.

Vol. I, *Trusts*, 1901. Vol. XIII, *Trusts and Industrial Combinations*.

Iron Age.

JENKS, J. W. *The Trust Problem*.

MCVEY, F. L. "The Tin-Plate Industry." *Yale Review*, vol. 7.

In Ripley, *Trusts, Pools, and Corporations*. 1898-99, pp. 302-18.

MONTAGUE, G. H. *Trusts of To-day*. New York, 1904.

MOODY, JOHN. *The Truth about the Trusts*.

PIERCE, FRANKLIN. *The Tariff and the Trusts*. New York, 1907.

Tariff Hearings. Committee of Ways and Means.

53d Congress, 1st Session, 1893.

60th Congress, 1908, Schedule C, vol. II.

62d Congress, 1912-13, Schedule C.

United States *versus* United States Steel Corporation. In District Court of the United States for the District of New Jersey. *Transcript of Record*, 10 vols.

United States Steel Corporation.

Report of the Stanley Committee. Report no. 1127 of House of Representatives.

Hearings of the Stanley Committee, 1911, 5 vols.

Report of the Commissioner of Corporations on The Steel Industry, 2 parts, July 1, 1911.

Wales

H. W. MACROSTY. *The Trust Movement in British Industry*. London, 1907.

Times. London.

Engineer. London.

Ironmonger. London.

Prices, Production, Imports and Exports.

British Blue-Books. Reports of Trade and Navigation.

British Trade Journal.

Iron Age.

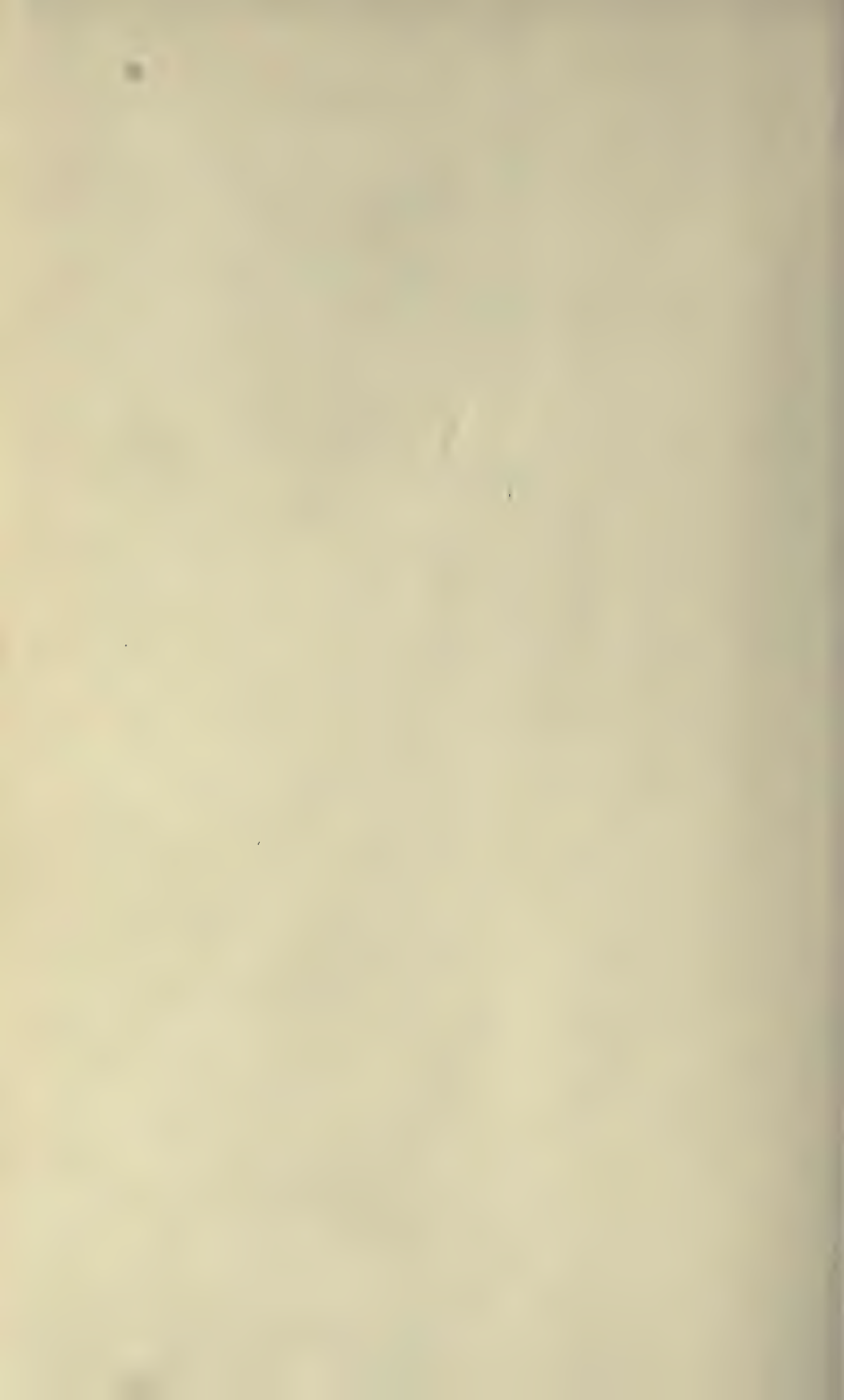
Ironmonger.

Statistical Abstract of the United States.

United States Reports of Commerce and Navigation.

American Iron and Steel Association Reports.

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